



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
CHEMICAL SAFETY AND POLLUTION PREVENTION

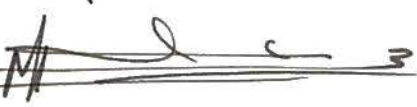
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

MEMORANDUM

SUBJECT: Drinking Water Exposure Assessment in Support of the Preliminary Risk Assessment for the Registration Review of Imidacloprid.

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EXECUTIVE SUMMARY

As explained in the background section below, the three most current drinking water assessments were executed for imidacloprid covering multiple new use patterns and changes in labels. This assessment considered all current registered uses of imidacloprid to calculate the estimated drinking water concentrations (EDWCs) based on current new models and changes in labels. Major conclusions from this assessment are as follows:

- (1) The driver for drinking water exposure is water from ground water sources with the highest **acute EDWC of 92 ppb of imidacloprid TTR** and the highest **chronic EDWC of 84.9 ppb of imidacloprid TTR** from *WI-corn ground water scenario*;
- (2) The highest surface water EDWCs are: **82 ppb of imidacloprid TTR** for the **acute** value from *FLcarrotSTD* scenario, **14.9 ppb of imidacloprid TTR** for the **chronic** value and **8.99 ppb of imidacloprid TTR** for the **cancer/chronic** value from *CAlettuceSTD* scenario.

Results stated in (1) and (2), above, represent the upper-bound estimates of total concentrations that might be found in ground/surface waters due to the use of imidacloprid as an insecticide on all currently registered use patterns. If more information or refinement is needed, please call Mohammed A. Ruhman at (703) 605-0644 or email: ruhman.mohammed@epa.gov

I. BACKGROUND

The *three most current* drinking water exposure assessments were:

The 1st Assessment: Drinking Water Assessment for Imidacloprid: IR-4 Registration of New Uses and Modified Application Rates (DP Barcodes: 3119-25/27/29/52, 3182-81/85/84/87, 3214-41/42/43/44/45/46, 3219-37/38/42/43/, 3234-40 and 3258-13 dated May 16, 2006): A surface/ground drinking water exposure assessment for new uses and for modified rates of application on several crops. The assessment was based on labeled uses for cotton, citrus, tropical fruits, oilseeds crop group (canola and rape/seed treatment), coffee, berries, pomegranate, tree nuts, banana and plantain, herbs, rye & oat (seed treatment?), brassicas and leafy vegetables. The maximum label rates were 0.50 lb. a.i/A/Year for most of the crops with seed treatment one order of magnitude lower (0.08 lb. a.i/A). **Tier 1 FIRST** modeling for surface water and **SCIGROW** for ground water were used. The assessment reported that the highest acute/chronic EDWC were **35.9/15.3 ppb** from usage on tree nuts and coffee. Acute/chronic EDWC for ground water was **1.43 ppb** based on **SCIGROW** modeling reported in an earlier drinking water assessment entitled ***Imidacloprid: Tier I Drinking Water EECs for Use in the Human Health Risk Assessment*** (DP Barcodes: 2717-70, 2718-25, 2787-61, 2854-89, 2857-42, and 2867-23 dated February 25, 2003).

The 2nd Assessment: New Use Drinking Water Assessment for Imidacloprid on Peanuts, Soybeans and IR-4 Registration for Crop Group 13A: Caneberries (DP Barcodes: 3340-29/30, 3327-56, 3331-22/23/25/26 and 3305-68/69 dated April 13, 2007). Exposure concentration values for all crops were calculated with the FQPA Index Reservoir Screening Tool (FIRST). New ground water concentration values were not estimated because they have been shown previously to be substantially lower in magnitude than the surface water. In this assessment, calculated EDWCs for the new imidacloprid uses did not exceed concentrations for crops evaluated previously and therefore overall result of this exposure assessment did not change previous drinking water exposure levels.

The 3rd Assessment: Tier I Estimated Environmental Concentrations of Imidacloprid for the Use in the Human Health Risk Assessment, Registration of a New Products for Seed Treatment, Sepresto 75WS, and New Use on Bulb Vegetables (Crop Group 3) for GAUCHO

550 (DP Barcode 3671-05 dated August 4, 2009). Surface/ground water EDWCs for Imidacloprid, were calculated using the tier I aquatic models **FIRST/SCI-GROW**. The conclusion of this assessment was that the previously assessed caneberries and citrus are still the uses with the major exposure (Application rate of 0.5 lb. a.i./A and the highest percent crop area (PCA) of 0.87). Therefore, no change in the drinking waters assessment results from previous assessment and the previous drinking water assessment still applies.

This drinking water assessment is conducted for the following reasons:

- (1) Support of the preliminary risk assessment for the registration review of imidacloprid;
- (2) Take in consideration changes in the labels such as restricting application of the pesticide during the flowering period;
- (3) Use of the current national default percent cropped area adjustment factor (PCA)¹ of 1.0 instead of 0.87 used previously due to the extensive use patterns of imidacloprid;
- (4) Consider newly submitted fate and transport data; and
- (5) Use current tier II pesticide water calculator (**PWC** version 1.52) for calculating surface water EDWCs instead of the tier I **FIRST** and use tier I **PRZM-GW** model for calculating ground water EDWCs instead of **SCI-GROW**. Detailed information about the current models used by EFED can be found at URL: <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment>

II. STRESSOR OF CONCERN

As per the Metabolism Assessment Review Committee (MARC) of the Health Effect Division (HED)² decision, imidacloprid parent, imidacloprid urea, imidacloprid guanidine, imidacloprid olefin are the residues of concern. These residues are the stressor of concern for the drinking water exposure assessment. In modeling, the total toxic residue approach will be used to calculate EDWCs which assumes that toxicity of imidacloprid parent is equal to each of the constituents of its residues.

mixture of **urea compound (NTN-33519)** and **Olefin compound (NTN-35884)**: Max 3%

¹ URL: <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/development-community-water-system-drinking-water>

² *IMIDACLOPRID; Health Effects Division (HED) Metabolism Assessment Review Committee (MARC) Decision Document*. DP Barcode D287400 dated February 13, 2003

III. PHYSICAL CHEMICAL AND FATE AND TRANSPORT PROPERTIES OF IMIDACLOPRID

Table 1 contains a summary of the chemical profile of imidacloprid. Data indicate that imidacloprid is highly soluble with low vapor pressure and Henry's Law Constants. These properties suggest that the chemical will be readily soluble for movement with water and that it is unlikely to volatilize to a meaningful degree. Furthermore, the K_{ow} for imidacloprid is low, and this property along with the high solubility are known attributes of systemic pesticides that can move upward in the plant with the xylem. Furthermore, the relative high persistence of imidacloprid in the soil system and its predicted mobility are characteristics of pesticides that are expected to leach and contaminate vulnerable ground water resources.

Table 1 Chemical profile of imidacloprid

Property	Value
Chemical Structure: Name	<p style="text-align: center;">Imidacloprid 1-(6-chloro-3-pyridin-3-ylmethyl)-N-nitroimidazolidin-2-ylidenamine</p>
CAS Number	138261-41-3
Molecular Formula	C ₉ H ₁₀ ClN ₅ O ₂
Molecular Weight (CAS No.)	255.7 g/mole (13826-41-3)
Water Solubility @ 20 °C	580-610 mg/L (ppm)
Octanol: Water Coefficient K_{ow}	3.7 @ 21 °C
Vapor pressure (Henry's Law Constant)	1.5 x 10⁻⁹ torr (9.9 x 10⁻¹³ atm m ³ mol ⁻¹) @ 20 °C

The environmental fate and transport characteristics of imidacloprid will be briefly discussed herein. Details will not be repeated here but can be found elsewhere³. Based on the various laboratory fate studies (**Table 2**), abiotic direct photolysis appears to be the major degradation pathway for imidacloprid. This type of abiotic degradation is expected to be important in shallow clear water bodies when light is available. Imidacloprid dissipation through abiotic photolysis in other types of water bodies is expected to be un-important due to light attenuation with depth and turbidity. In contrast, the chemical is expected to resist biotic metabolism in the aerobic soil system but is expected to be affected by aerobic/anaerobic degradation in aquatic systems producing the degradate guanidine. Based on laboratory batch equilibrium studies, parent imidacloprid is expected to be moderately mobile ($K_{oc} = 266 \text{ L Kg}^{-1}$, $n=15$; FAO Classification). Soil persistence/mobility data suggest that imidacloprid has the potential to leach to groundwater and/or to move to surface waters in run-off and this potentially may exist for long periods of time depending on soil and climatic conditions. Leaching of imidacloprid was confirmed in the field by two prospective ground water (PGW) studies. In both studies, the predominant compound detected in soil, soil-pore water throughout the vadose zone, and in ground-water (when detectable) was parent imidacloprid. Of the three degradates analyzed for (guanidine, olefin, and urea compounds) only the urea compound leached at concentrations that were frequently detectable in the shallow ground water. It was noted that detections in ground water (*i.e.*, breakthrough) started after 500 days from application and continued five years after application. Residues of imidacloprid in ground water were most frequently observed under use conditions which promoted greater ground-water recharge and/or when imidacloprid was used in multiple growing seasons at the same site.

³ *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* (DP Barcode 435477 dated December 31, 2016)

Table 2 Fate and transport properties for imidacloprid

Property	Values	MRID
Hydrolysis $t_{1/2}$	Stable @ pH 5, 7 and hydrolyzed slowly (Extrapolated $t_{1/2}$ = 355 d) in sterile alkaline solutions @ pH 9	420553-37
Direct Aqueous Photolysis $t_{1/2}$	0.2 days <u>Major Metabolites:</u> Guanidine or desnitro compound (NTN-38014) and urea compound (NTN-33519)	422563-76
Soil Photolysis $t_{1/2}$	171 days in a sandy loam soil from Kansas	422563-77
Aerobic soil $t_{1/2}$	608 days in a sandy loam soil from Kansas; 172 days in a loamy sand soil from Germany; 193 days in a silt soil from Germany; 336 days in a sandy loam soil from Germany; 139 days in a silt loam soil from Germany; 242 days in a sandy loam soil from Germany; 332 days in a sandy loam soil from Germany; and 177 days in a silt loam soil from Germany <u>Major Metabolites:</u> None <u>Minor Metabolites:</u> Max total of 4-11% consisting of varied/low amounts (Max 0.2-2% each) of: Olefin compound (NTN-35884); WAK-4230-1; Nitrosamine compound (WAK-3839); Guanidine compound (NTN-33823) and = Two isomers of 5-keto-urea compounds <u>Mineralization to CO₂:</u> Max 6.4-10%	420735-01; 452393-01; 452393-02; 452393-03; 498358-02 W/498358-03; and 422563-78
Anaerobic Aquatic $t_{1/2}$	33 days in pond water sediment system from Stanly, Kansas <u>Major Metabolites:</u> Guanidine= Max 21% <u>Minor Metabolites:</u> None; <u>Mineralization to CO₂:</u> Max 0.2-0.5%	422563-78
Aerobic Aquatic $t_{1/2}$	32 days in system 1: an orchard ditch water: loamy silt sediment; and 159 days in system 2: a re-cultivated quarry water: loamy sand sediment. Both from the Netherlands <u>Major Metabolites:</u> Guanidine= 12% in system 1 and None in system 2 <u>Minor Metabolites:</u> 6-chloronicotonic Acid and DIJ 9646-2= Max ≤1% in system 1 and Guanidine= Max 9% ; 6-chloronicotonic Acid= 4% ; and DIJ 9646-2= Max 2% in system 2 <u>Mineralization to CO₂:</u> Max 1.4% in system 1 and Max 2% in system 2 @ EOS	484169-01
Average K_{oc} ((L Kg⁻¹)	<u>Parent:</u> Average= 266 (n=15) ranging from 98-487 in soils with varied texture, Clay= 1 to 43% , Organic carbon (O.C)= 0.23 to 3.95% , pH= 4.5 to 7.8 , and Cation exchange capacity (C.E.C)= 4 to 41 meq/100 g <u>Guanidine Metabolite:</u> Average= 742 (n=4) ranging from 327 to 942 in soils with varied texture (Sand, Loamy sand, Sandy loam and Loam, O.C= 0.23 to 1.51% , pH= 5.1 to 6.5 , and C.E.C= 4 to 16 meq/100 g	<u>Parent:</u> 425208-01 420553-38; 476994-44 <u>Metabolite:</u> 425208-02

Figure 1 contains a summary for the degradation pathway of imidacloprid which indicates that the major exposure of concern is parent due to its persistence in the soil system as it produces minor amounts of many degradates. Parent reaching surface waters by run-off and drift is expected to mainly produce the degradate guanidine among other degradates at low level. at relatively low levels. When forms, guanidine shows only limited degradation and is expected to be slightly less mobile than its parent imidacloprid ($K_{oc} = 742 \text{ L Kg}^{-1}$, $n=15$).

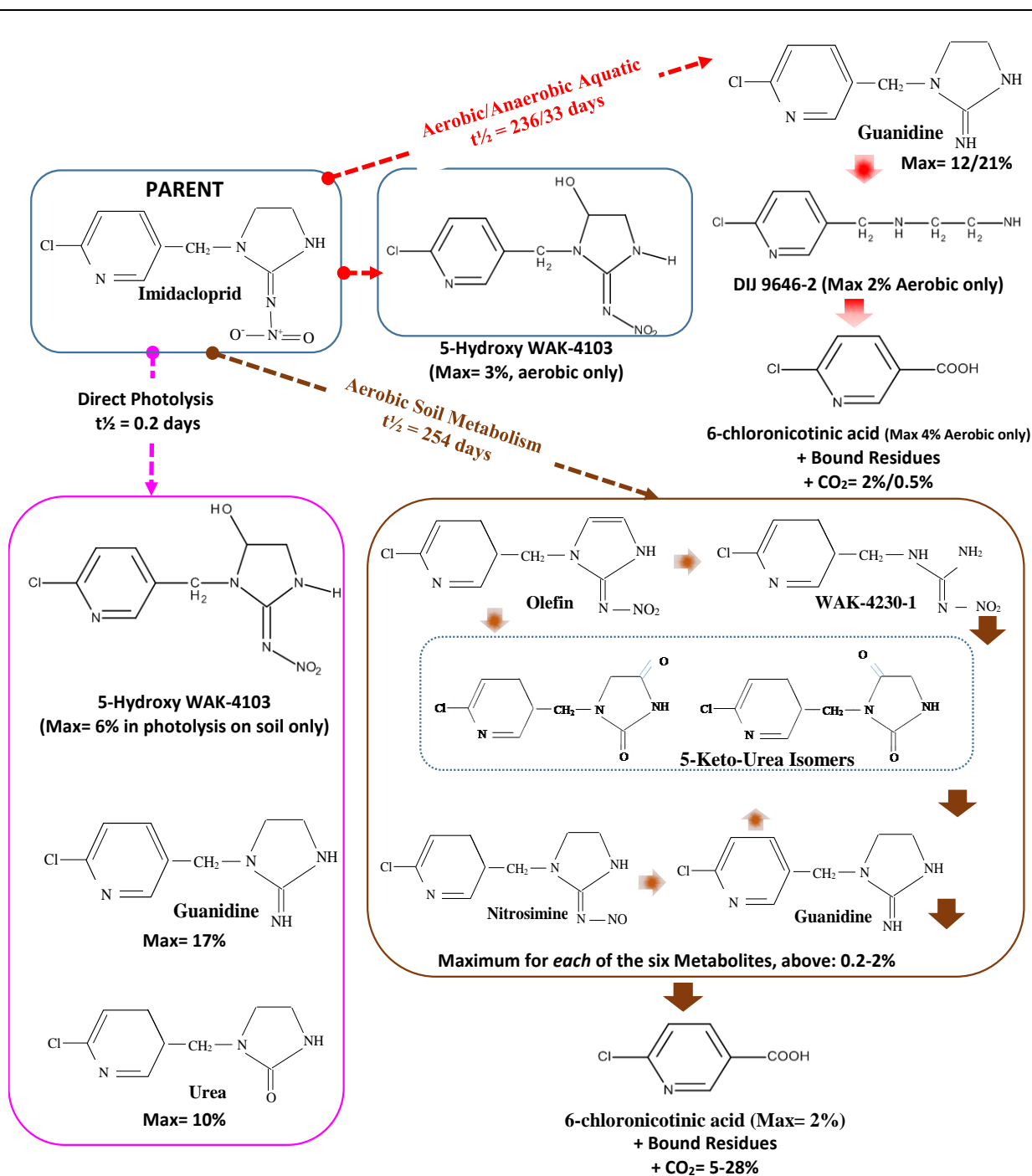


Figure 1 Expected degradation profile for imidacloprid in various compartments of the environment

IV. SURFACE WATER MODELING

Many types of applications are used in applying imidacloprid products including foliar, soil and seed treatment. Soil and seed treatment deliver the pesticide on the top soil or at depth with minimal drift while air or ground foliar application generates drift (ranges from 2-4% after consideration of labeled buffer zones). Therefore, much of the applied pesticide is expected to reach the soil system in which it is relatively persistent and expected to be affected by plant up-take, leaching and run-off. Amounts reaching surface water by run-off and drift are expected to degrade, rather slowly, into the main degradate guanidine. Both parent imidacloprid and to a lesser extent the degradate guanidine are expected to contaminate ground and surface waters.

Tier II PWC (version 1.52)⁴ modeling is used to calculate surface EDWCs for this drinking water exposure assessment. This assessment is for all current use patterns of imidacloprid and modeling followed the following steps:

Step 1: Choosing the use patterns for modeling: Labeled use patterns of imidacloprid may be categorized into two main categories, namely: **agricultural** and **non-agricultural**. Agricultural use patterns include: Foliar use patterns whereas the end-use products (EUPs) are diluted and applied directly to the crop foliage as liquid sprays mainly by ground, air or air-blast for tree crops; Soil use patterns whereas the EUPs are either diluted and applied directly to the soil as liquid spray/drench or applied **as is** directly into the soil (e.g., granules); and seed treatment use patterns whereas the EUPs is applied as a seed coating in varied seed treatment procedures. Non-agricultural use patterns include: turf & ornamentals in nurseries and residential/commercial areas; poplar/cottonwood and x-mass trees plantations; forestry; bait & pellets in farms/ residential/commercial areas; and special uses such as the product used for controlling burrowing shrimp in commercial shellfish beds in Willapa Bay, WA.

Important application parameters for imidacloprid use patterns are summarized in **Appendix I**. For the drinking water assessment, EFED consider the highest exposure from all use patterns for the chemical in question. Identifying the highest exposure for imidacloprid was difficult because of its extensive use patterns which vary in application procedures, rates, intervals, restrictions, combined applications, and in most cases application windows extending from planting to near harvesting.

Examination of imidacloprid labels indicates that the maximum rate may range from 0.07 to 0.50 lb. a.i./A for seed/seedling, from 0.18 to 0.5 lb. a.i./A (in one application) for soil applications, from 0.10 to 0.5 (in one to six applications) for foliar applications. By using the lower rates (within the application ranges stated above), many combinations of soil and foliar applications may be obtained such as: one soil application at 0.125 lb. a.i./A plus three foliar applications of 0.125 lb. a.i./A ($0.125 \times 3 = 0.375$); a total of 0.5 lb. a.i./A per season or year ($0.125 + 0.375$). However, it is important to point out that it is difficult to predict what kind of a combined application will be chosen by the farmer as it is expected to vary depending on such factors as application cost, timing

⁴ URL for water models: : <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/models-pesticide-risk-assessment>

of pest pressure, available application equipment, and soil and weather conditions among many others. From preliminary modeling runs, it was noted that, in most cases, the lowest EDWCs are expected to result from the combined rate achieved by reducing the rate for foliar application, while the highest EDWCs will result from the combined rate achieved by reducing the rate for soil application. This is because soil application places most or all the pesticide mass below the 2-cm runoff extraction zone of the model (reduce mass of pesticide carried by runoff). To deal with this problem of choosing the application rates for the combined applications, the Agency conservatively used the reduction in the soil application rate, when possible.

Step 2: Choosing other parameters: In addition to labeled use patterns, modeling for surface water EDWCs requires choosing many other parameters including: the chemical fate and transport parameters, application dates, application method(s), drift fraction and representative scenario(s).

Detailed information on how the different modeling parameters were chosen for steps 1 and 2 can be found elsewhere⁵. As stated previously, EFED consider the highest exposure from all use patterns for the chemical in question. Therefore, only a small set of use patterns with expected high exposure were modeled for this drinking water assessment. The high exposure use patterns were chosen based on a preliminary modeling exercise and results obtained from extensive modeling executed for the referenced ecological risk assessment. Additionally, major use patterns were included in the chosen set of use patterns (based on usage data). Hereunder, the use patterns and parameters used for modeling EDWCs for imidacloprid.

Chemical Input parameters

Required chemical parameters are based on the physical, chemical, fate and transport properties of imidacloprid and are selected as per the guidance⁶. It is noted, however, that the modeling approach used for imidacloprid is the total toxic residue (TTR) which requires recalculation of half-lives for the stressor of concern (parent, imidacloprid urea, imidacloprid guanidine, imidacloprid olefin). The TTR half-lives were calculated from submitted fate data for aqueous photolysis and aerobic/anaerobic aquatic systems. It is noted however that the TTR half-lives were not calculated for the aerobic soil because parent was the dominant species in the residues and other species of the TTR were observed at very low concentrations (0.2 to 3%).

Aqueous photolysis half-life of 5.4 days was estimated for the TTR using PEST-DF (Based on NAFTA degradation kinetics (**Figure 2**)). Other TTR half-lives were also estimated using the same

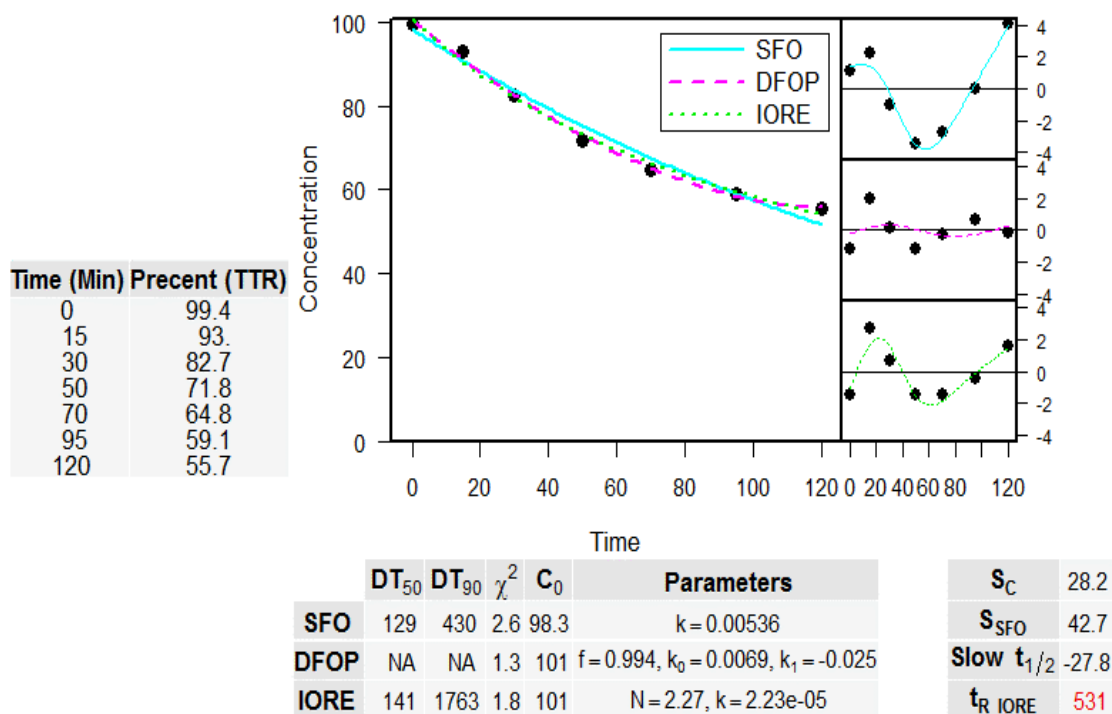
⁵ *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* (DP Barcode 435477 dated December 31, 2016)

⁶ The chemical parameters guidance is available at US EPA web; URL: <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-selecting-input-parameters-modeling>

procedure used for aqueous photolysis. The estimates were: 51 days for system 1/aerobic aquatic, 305 days for system 2/aerobic aquatic and 100 days for one anaerobic aquatic system (all at 22 °C; **Figure 3**). After correcting for the temperature, these half-lives became: 81 and 248 days for systems 1 and 2 and 41 days for the single anaerobic aquatic system (all at 25 °C).

Figure 2 Hydrolysis half-life estimate of PEST-DF (SFO chosen value of 129 hours=5.4 days)¹

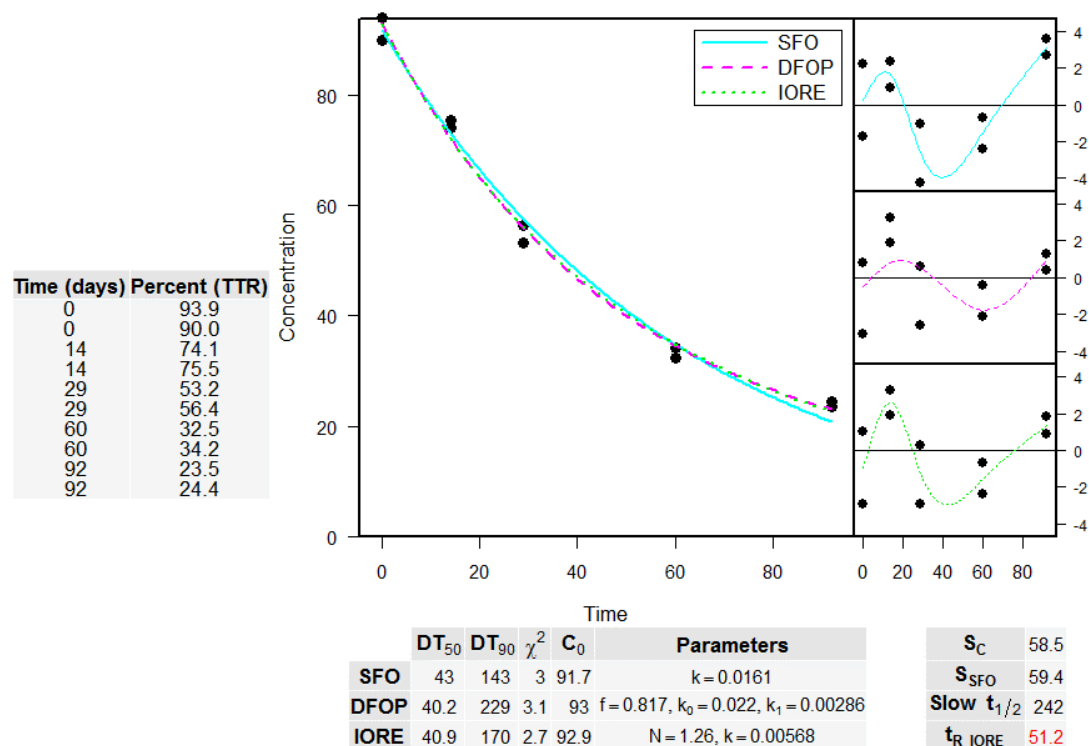
H2O Photolysis MRID 4225632-76



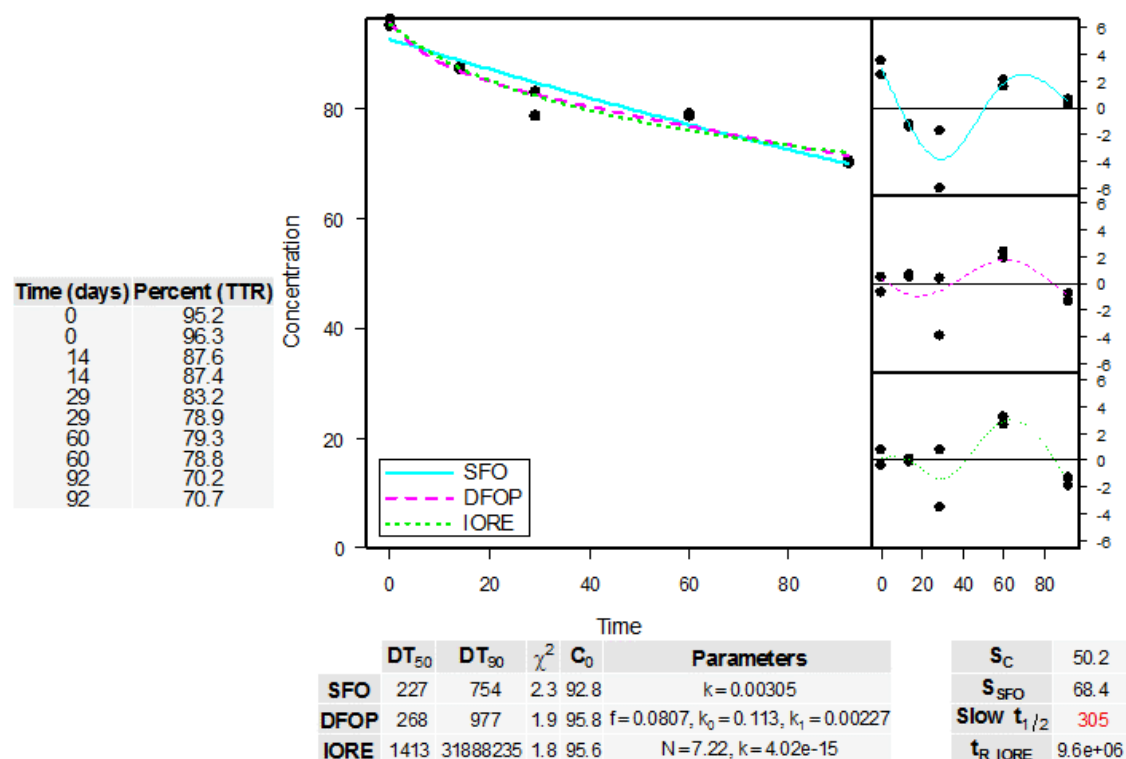
¹ Values for half-lives were estimated as per NAFTA degradation kinetic: SFO model= Single Order; DFOP model= Double First Order; and IORE model= Indeterminate Order Rate Equation

Figure 3 TTR half-lives estimates: Aerobic aquatic system 1= 51 days (IORE) and system 2= 305 days) and anaerobic aquatic= 100 days (IORE)¹

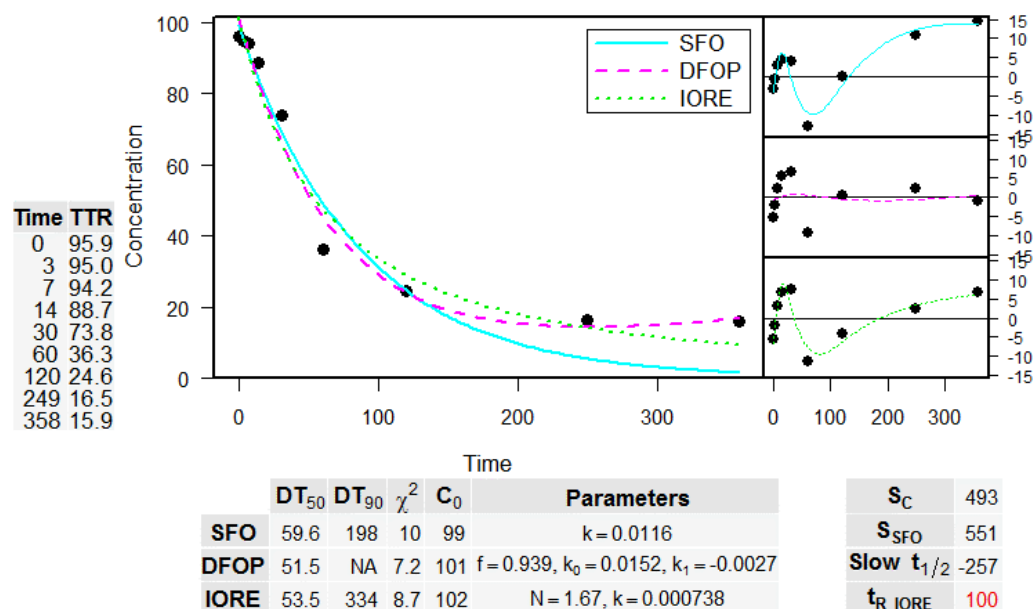
Aerobic Aquatic LSi MRID 484169-01 TTR



Aerobic Aquatic LS MRID 484169-01 TTR



Anaerobic Aquatic: TTR; Kansas Pond MRID 422563-78



¹ Values for half-lives were estimated as per NAFTA degradation kinetic: SFO model= Single Order; DFOP model= Double First Order; and IORE model= Indeterminate Order Rate Equation

Chemical parameters used for modeling are summarized in **Table 3**.

Table 3 TTR chemical input parameters for drinking water modeling of imidacloprid

Parameter	Value	Reference
Sorption Coefficient (K _{oc} , L Kg ⁻¹)	266	Parent average for 15 soils (MRIDs 425208-01; 420553-38 & 476994-44) ¹ .
Water Column Metabolism t _{1/2} (day)	463 @ 25 °C	TTR upper 90 th confidence limit on the mean t _{1/2} from two values/systems (MRID 484169-01)
Benthic Metabolism t _{1/2} (day)	243 @ 25 °C	TTR for One system t _{1/2} of 81 days X 3= 243 days (MRID 422563-78)
Aqueous Photolysis t _{1/2} /Latitude (day)	5.4 @ 40°	TTR (MRID 422563-76)
Hydrolysis t _{1/2} (day)	0=Stable	MRID 490111-21
Aerobic Soil Metabolism t _{1/2} (day)	254 @ 25 °C	Parent upper 90 th confidence limit on the mean t _{1/2} from eight values for parent (MRIDs 420735-01; 452393-01/02/03; 498358-02)
Molecular Weight (g mole ⁻¹)	255.7	
Vapor pressure (torr)	1.5 x 10 ⁻⁹	
Solubility in Water mg L ⁻¹	610	
Henry's Law Constant (unitless)	3.38 x 10 ⁻¹¹	
Spray Drift (Efficiency)	Ground (3.22%); Aerial (4.21%)	Calculated using AgDRIFT and labeled buffer zones ²
Cropped Area Fraction	1 (multiple crops)	

¹ Parent value was used because it dominates the TTR

² Reference: *Guidance on Modeling Offsite Deposition via Spray Drift for Ecological and Drinking Water Assessments*. The document was released for public comment on 3/26/2014 and the Agency received over 5000 public comments (Docket ID; EPA-HQ-OPP-2013-0676). The finalized guidance document is yet not available on the Agency's website, but a courtesy copy is available upon request

Other Parameters

Other parameters needed for modeling chosen use patterns are summarized in **Table 4**; noting that chosen represented scenarios for these use patterns are included in the output summary, below (**Table 5**)

Table 4 Application parameters use for modeling various use patterns

Crop Group	Use Pattern	Application Type/Rate Kg a.i/ha/Intervals			Application Date(s)
		SD-SDL ¹	Soil	Foliar	
1 - Root and Tuber Vegetables	Potato	0	0.337	0.056 x 4 @ 7 d.	2-Feb; 9-Feb
	Others	0	0.414	0.049 x 3 @ 5 d.	9-Oct; 14-Oct
3 – Bulb Veg. Vegetables	Onion	0.178	0.382	0	8-sep; 15- Sep
4- Leafy Green Vegetables	Leafy-Green	0	0.296	0.053 x 5 @ 5 d.	21-Feb; 26 Feb
5 - Brassica (Cole) Leafy Vegetables	Brassica	0	0.296	0.053 x 5 @ 5 d.	
6 - Legumes	Soybeans	0.235	0	0.0523 x 3 @ 7 d.	2-Apr; 9-April
8 - Fruiting Vegetables	Peppers	0.052	0.239	0.090 x 3 @ 5 d.	1-sep; 18-oct; 2-nov
	Others	0.036	0.120	0.090 x 3 @ 5 d.	7-Feb; 14-Feb; 7-Mar
9- Cucurbit Vegetables	Cucurbit	0	0.426	0	9-Oct
10 - Citrus	Citrus	0	0	0.2805 x 2 @ 10 d.	28-Aug
11 - Pome Fruits	Pears	0	0	0.2805 x 2 @ 10 d.	10-Jul
11 - Pome Fruits	Others	0	0	0.1121 x 5 @ 10 d.	30-Jul
12 - Stone Fruits	Cherries	0	0	0.1121 x 5 @ 10 d.	9-Aug
13- Berries	Bushberry	0	0	0.1121 x 5 @ 7 d.	31-May
	Strawberry	0	0.402	0.053 x 3 @ 5 d.	6-Jan; 14-Jan
	Grape	0	0.449	0.056 x 2 @ 14 d.	25 August; 8-sept
14 - Tree Nuts	Tree nuts	0	0.161	0.100 x 4 @ 6 d.	
20 - Oilseed	Cotton	0.106	0.119	0.067 x 5 @ 7 d.	9-mar; 16-mar; 27-apr
No Crop Group	Coffee	0	0	0.1121 x 5 @ 7 d.	1-Nov
Non-Ag	Poplar	0	0	0.1121 x 5 @ 10 d.	5-Jun
	X-mass Trees	0	0	0.1121 x 5 @ 7 d.	16-Nov
	Nurseries	0	0	0.448	16-Mar
	Turf	0	0	0.561	18-Sep

¹ SD-SDL: Seed or Seedling rate

Modeling Output

Modeled surface water EDWCSs are presented in Table 5.

Table 5 Modeled surface water EDWCSs

Crop Group	Use Pattern	Scenario	EDWCs (ppb)		
			Peak	Yearly Average	Overall Average
			Acute	Non-Cancer Chronic	Cancer Chronic
	Potato	FLpotatoNMC	7.8	1.67	1.08
1 - Root and Tuber Vegetables	Carrot	FLcarrotSTD	82.0	9.90	5.39
3 - Bulb Vegetables	Onion	GAOnion_WirrigSTD	19.2	3.22	1.16
4- Leafy Green Vegetables	Leafy-Green	CAlettuceSTD	31.7	14.90	8.99
5 - Brassica (Cole) Leafy Vegetables	Brassica	CAColeCropRLF_V2	26.0	11.30	7.71
6 - Legumes	Soybeans	MSsoybeanSTD	6.8	1.60	0.75
8 - Fruiting Vegetables	Peppers	FLpeppersSTD	14.3	2.34	1.36
8 - Fruiting Vegetables	Others	FLtomatoSTD_V2	9.7	1.47	0.82
9- Cucurbit Vegetables	Cucurbit	FLcucumberSTD	17.7	2.17	1.04
10 - Citrus	Citrus	FLcitrusSTD	26.8	4.43	3.17
11 - Pome Fruits	Pears	NCappleSTD	27.4	7.07	3.66
11 - Pome Fruits	Others	NCappleSTD	17.7	6.12	3.30
12 - Stone Fruits	Cherries	MICherriesSTD	13.7	7.18	4.46
	Bushberry	ORberriesOP	2.6	1.28	0.92
	Strawberry	CAStrawberry-noplasticRLF_V2	10.0	3.83	2.11
13- Berries	Grape	NYGrapesSTD	3.2	1.38	0.86
14 - Tree Nuts	Tree nuts	GApecansSTD	16.0	3.05	1.65
20 - Oilseed	Cotton	STXcottonNMC	25.8	6.65	3.77
No Crop Group	Coffee	PRcoffeeSTD	33.7	6.32	3.73
	Poplar	PAappleSTD_V2	11.2	4.18	2.53
	X-mass Trees	ORXmasTreeSTD	5.1	2.98	2.04
	Nurseries	TNnurserySTD_V2	36.5	8.19	2.10
Non-Agriculture	Turf	FLturfSTD	7.5	2.97	1.63
Maximum EDWCs			82.0	14.90	8.99

Results in **Table 5**, above indicate that maximum EDWCs are: Acute= **82 ppb of TTR** from *FLcarrotSTD* scenario and Non-Cancer Chronic= 14.9 ppb of TTR and Cancer Chronic= 8.99 ppb of TTR from *CAlettuceSTD* scenario.

III. GROUND WATER MODELING

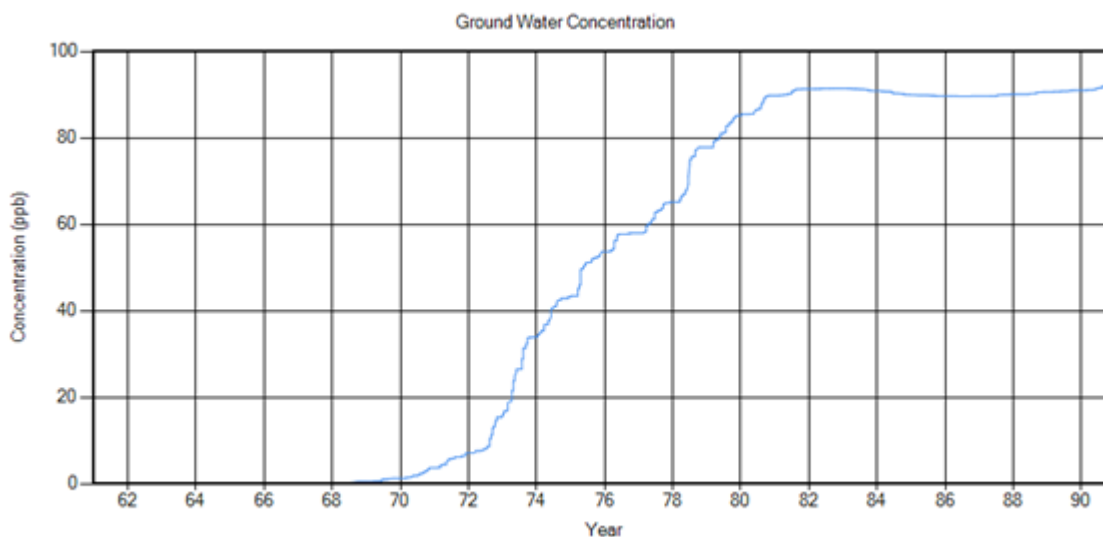
The maximum use rate for all crops is 0.50 lbs. a.i/A on almost all of the crop use patterns. A batch run was executed for all available scenarios. In this run, the following parameters were used: Application rate= 0.561 kg/ha; Sorption Coefficient (K_{oc}) = 266 L Kg⁻¹; and Aerobic Soil Metabolism $t_{1/2}$ = 254 days (refer to **Table 3**, above).

Results are summarized in Table 6 indicate that the highest ground water EEDWCs are: **92 ppb of the TTR for the acute** value and **84.9 ppb of TTR for the chronic** value. These values were obtained for *WI-corn ground water scenario* (Table 6 and Figure 4).

Table 6 Modeled EDWCs resulting from use on all crops

Scenario	Highest Daily Value (ppb)	Post Breakthrough Average (ppb)	Overall Simulation Average (ppb)	Average Breakthrough Time in Days (Years)
WI_corn_ForQA_+0	92.0	84.9	46.6	5,768 (15.8)
FLCitrus_PWC_+0	67.0	59.1	45.5	3,383 (09.3)
NCCotton_PWC_+0	62.0	54.7	33.4	4,417 (12.1)
Delmarva_PWC_+0	53.6	49.8	31.1	4,194 (11.5)
GA peanuts_ForQA_+0	21.7	20.4	11.9	5,229 (14.3)
FL potato_ForQA_+0	4.2	3.4	2.4	5,323 (14.6)

Figure 4 Aquifer Breakthrough Curve for imidacloprid and the WI corn scenario



Attachment I: Labeled Use Patterns Tables

Table A-1 contains a list of the crops belonging to listed crop group and subgroup in various imidacloprid labels. Data indicates that imidacloprid can be used in an extensive list of crops that are planted in extensive agricultural land.

Table A-1 Alphabetical order listing of crops belonging to crop groups/subgroups in various labels for the agricultural use patterns

Crop Group/Subgroup	Designation	Crops
Bearing fruits grown in Residential & Commercial area		Avocado; Citrus (orange, Calamondin, grapefruit, kumquat, lemon, lime, tangerine, and tangelo); Pecans; Grapes and Pome fruits (Apple, Crabapple, Loquat, Mayhaw, Pear, Oriental Pear, Quince);
Brassica (Cole) Leafy Vegetables	05	Broccoli, Broccoli raab (<i>rapini</i>), Brussels sprouts, Cabbage, Cauliflower, Cavalo broccoli, Chinese (<i>gai lon</i>) broccoli, Chinese (<i>bok choy</i>) cabbage, Chinese (<i>napa</i>) cabbage, Chinese mustard (<i>gai choy</i>) cabbage, Collards, Kale, Kohlrabi, Mizuna, Mustard greens, Mustard spinach, Rape greens
Bulb Vegetables	03-07	Chive (fresh leaves), Chinese chive (fresh leaves), Daylily (bulb), Elegans hosta, Fritillaria (bulb and leaves), Garlic (common group, great-headed group, serpent group), Kurrat group, Leek group (including common, lady's and wild), Lily (bulb), Onion (bulb and green leaves including: common group, Beltsville bunching, Chinese bulb, fresh, green, macrostem, Pearl group, potato onion group, tree onion-tops, Welsh-tops), Shallot, plus cultivars, varieties, and/or hybrids of these
Bushberry	13-07-B	Blueberry, Currant, Elderberry, Gooseberry, Huckleberry, Juneberry, Ligonberry, Salal
Caneberry	13-07-A	Blackberry: (<i>Rubus eubatus</i>): bingleberry, black satin berry, boysenberry, Cherokee blackberry, Chesterberry, Cheyenne blackberry, coryberry, darrowberry, dewberry, Dirksen thornless berry, Himalayaberry, hullberry, Lavacaberry, Loganberry, Lowberry, Lucretiaberry, mammoth blackberry, Marionberry, Nectarberry, Olallieberry, Oregon evergreen berry, Phenomenalberry, Rangeberry, Ravenberry, Rossberry, Shawnee blackberry, youngberry, and varieties and/or hybrids of these); Raspberry: black and red: <i>Rubus occidentalis</i> , <i>Rubus strigosus</i> , <i>Rubus idaeus</i>
Citrus	10	Calamondin, Citrus citron, Citrus hybrids (includes chironja, tangelo, and tangor), Grapefruit, Kumquat, Lemon, Lime, Mandarin (tangerine), Pummelo, Orange (sweet and sour), Satsuma mandarin, and other cultivars and/or hybrids of these
Cucurbit Vegetables	09	Chayote (fruit), Chinese waxgourd (Chinese preserving melon), Citron melon , Cuban pumpkin, Cucumber , Gherkin, Gourd (edible, includes hyotan, cucuzza, hechima, Chinese okra), <i>Momordica</i> spp. (includes balsam apple, balsam pear, bitter melon, Chinese cucumber), Muskmelon (hybrids and/or cultivars of <i>Cucumis melo</i> including true cantaloupe, cantaloupe, casaba, Crenshaw melon, golden pershaw melon, honeydew melon, honey balls, mango melon, Persian melon, pineapple melon, Santa Claus melon, snake melon and Winter melon), Pumpkin, Squash (includes summer squash types such as: butternut squash, calabaza, crookneck squash, Hubbard squash, scallop squash, straightneck squash, vegetable marrow and zucchini, and winter squash types such as acorn squash and spaghetti squash), Watermelon (includes hybrids and/or varieties of <i>Citrullus lanatus</i>)
Fruiting Vegetables	08	Eggplant, Ground cherry, Okra, Pepper (including bell, chili, cooking, pimento and sweet) Tomato , Pepinos, Tomatillo
Grape		American bunch grape , Muscadine grape and Vinifera grape
Herbs & Spices	19-A	Angelica, Balm (lemon balm), Basil (fresh and dried), Borage, Bumet, Camomile, Catnip, Chervil (dried), Chinese chive, Chive, Clary, Coriander (cilantro or Chinese parsley leaves), Costmary, Culantro (leaf), Curry (leaf), Dillweed, Horehound, Hyssop, Lavender, Lemongrass, Lovage (leaf), Marigold, Marjoram, Nasturtium, Parsley (dried), Pennyroyal, Rosemary, Rue, Sage,

Crop Group/Subgroup	Designation	Crops
		Savory (summer and winter), Sweet bay (bay leaf), Tansy, Tarragon, Thyme, Wintergreen, Woodruff, Wormwood.
Hops		

Table A-1 (Continues) Alphabetical order listing of crops belonging to crop groups/subgroups in various labels for the agricultural use patterns

Crop Group/Subgroup	Designation	Crops
Leafy Green Vegetables, including Watercress	04-A	Amaranth (leafy amaranth, Chinese spinach, tampala), Arugula (Roquette), Chervil, Chrysanthemum (edible leaved and garland), Corn salad, Cress (garden), Cress (upland, yellow rocket, winter cress), Dandelion, Dock (sorrel), Endive (escarole), Lettuce (head and leaf), Orach, Parsley, Purslane (garden and winter), Radicchio (red chicory), Spinach (including New Zealand and vine (Malabar spinach, Indian spinach)) and Watercress (commercial production only, applications must not be made to native cress growing in streams or other bodies of water), Watercress (upland)
Leafy Petiole Vegetables	04-B	Cardoon, Celery, Celtuce, Chinese celery (fresh leaves and stalk only), Florence fennel (including sweet anise, sweet fennel, Finocchio), Rhubarb, Swiss chard
Legume Vegetables, Except Dry Soybeans	06-C	Edible Podded and Succulent Shelled Pea and Bean and Dried Shelled Pea and Bean: Bean: <i>Lupinus</i> spp.: grain lupin, sweet lupin, white lupin, and white sweet lupin; <i>Phaseolus</i> spp.: field bean, kidney bean, lima bean, navy bean, pinto bean, runner bean, snap bean , tepary bean, wax bean); and <i>Vigna</i> spp.: adzuki bean, asparagus bean, blackeyed pea, catjang, Chinese longbean, cowpea, Crowder pea, moth bean, mung bean, rice bean, Southern pea, urd bean, yard-long bean; Pea: <i>Pisum</i> spp.: dwarf pea, edible-pod pea, English pea, field pea, garden pea, green pea, snow pea, sugar snap pea); Other Beans and Peas: Broad bean (fava), Chickpea (garbanzo bean), Guar, Jackbean, Lablab bean (hyacinth bean), Lentil, Pigeon pea, Soybean (immature seed) , Sword bean]
Pome Fruits	11	Apple , Crabapple, Loquat, Mayhaw, Pear (including Oriental pear), Quince
Root Vegetables, Except Sugarbeet	01-B	Beet (garden), Burdock (edible), Carrot , Celeriac, Chervil (turnip-rooted), Chicory, Ginseng, Horseradish, Kava, Parsley (turnip rooted), Parsnip, Radish, Oriental radish (diakon) Rutabaga, Salsify (oyster plant), Salsify (black), Salsify (Spanish), Skirret and Turnip.
Stone Fruits	12	Apricot, Cherry (including sweet and tart), Nectarine, Peach , Plum (including Chickasaw, Damson and Japanese), Plumcot, Prune (fresh and dried)
Tree Nuts	14	Almond, Beechnut, Brazil nut, Butternut, Cashew, Chestnut, Chinquapin, Filbert , Hickory nut, Macadamia nut, Pecan , Pistachio, Walnut [black and English]
Tropical Fruits		Acerola, Atemoya, Avocado, Birida, Black sapote, Canistel, Cherimoya, Custard apple, Feijoa, Jaboticaba, Guava, Llama, Longan, Lychee, Mamey sapote, Mango, Papaya, Passionfruit, Persimmon, Pulasan, Rambutan, Sapodilla, Soursop, Spanish lime, Star apple, Starfruit, Sugar apple, Wax jambu
Tuberous and Corm Vegetables	01-C	Arracacha, Arrowroot, Artichoke (Chinese and Jerusalem), Canna (edible, Queensland arrowroot), Cassava (bitter & sweet), Chayote (root), Chufa, Dasheen (taro), Ginger, Leren, Sweet potato , Tanier (cocoyam), Turmeric, Yam bean (jicama, manioc pea), Yam (true)

Foliar Application

- **Table A-2** contains a summary of sample formulations used for foliar applications of imidacloprid. The summary is based on a sample of 14 labels. Data indicate that imidacloprid designated for foliar application appears to be mainly formulated as a flowable/water dispersible

granules/powder which is applied as liquid spray. Additionally, the active ingredient in eleven of the examined formulations is imidacloprid alone with concentrations ranging from 16.5 to 75% with three of the formulations containing imidacloprid concentrations ranging from 11 to 21% and one of the following active ingredients: 12% Cyfluthrin, 10.5% β -Cyfluthrin, and 11% Spirotetramat. It is important to note that the summary in **Table A-2** is based on examination of most of the current imidacloprid labels (not just those shown the table). This examination was conducted to insure that maximums for the single/seasonal or annual rates, maximum number of applications and minimum application intervals are representative of most current imidacloprid labels;

- **Table A-3** contains a summary of the foliar use patterns for imidacloprid. The formulations are applied as a liquid spray that can be applied by ground or air with airblast for tree crops or by chemigation; except grapes and post-harvest application for strawberry. **Table A-3** contains the application parameters, and the application window for each crop/crop group/sub-group along with application restrictions related to pollinator production;
- **Table A-4** contains restricted period in the foliar application windows for pollinator protection.

Table A-2 A summary of sample formulations used for foliar applications of imidacloprid

<i>Product Name</i>	<i>Formulation</i>	<i>EPA Reg. No.</i>	<i>Active Ingredient(s) %</i>
ADMIRE® PRO™	Flowable	264-827	42.8% Imidacloprid alone
GAUCHO® 550 SC Insecticide	Flowable	264-827	42.8% Imidacloprid alone
LEVERAGE® 2.7 Insecticide	Suspension Emulsion	264-770	17.0% Imidacloprid + 12.0% Cyfluthrin
LEVERAGE® 360 Insecticide	Flowable	264-1104	21.0% Imidacloprid + 10.5% β -cyfluthrin
MOVENTO® RC	Flowable	264-1170	11.0% Imidacloprid + 11.0% Spirotetramat
PROVADO 70 WG	Wettable Granules	264-823	70.0% Imidacloprid alone
PROVADO® PRO Insecticide	Flowable	264-858	16.5% Imidacloprid alone
PROVADO® Solupak 75%	Water Soluble Package	264-761	75.0% Imidacloprid alone
ROVADO® 1.6	Flowable	264-763	17.4% Imidacloprid alone
AmTide Imidacloprid 75% WDG Insecticide	Water Dispersible Granules	83851-7	75.0% Imidacloprid alone
Willowood Imidacloprid 4SC	flowable	87290-26	40.7% Imidacloprid alone
MALLET® 75 WP INSECTICIDE	Wettable Powder	228-588	75.0% Imidacloprid alone
TR1MAX™ PRO Insecticide	Flowable	264-855	40.7% Imidacloprid alone
TRIMAX™ Insecticide	Flowable	264-783	40.7% Imidacloprid alone

Table A-3 Foliar use patterns for imidacloprid

<i>Use Pattern (Crop Group)</i>	<i>Application Parameters¹</i>				<i>Application Window (Refer to Pollinator Statements Number)</i>
	<i>MSR</i>	<i>MNA</i>	<i>MAR</i>	<i>MAI</i>	
Artichoke, Globe	0.125	4	0.500	14	AP up to 7 d. PH
Banana and Plantain	0.100	5	0.500	14	Anytime up to 0 d. PH
Brassica (cole) Vegetables (05)	0.047	5	0.234 ³	5	Anytime up to 7 d. PH
Bulb Vegetables (3-07)	No Foliar Application				
Bushberry (13-7-B)	0.100	5	0.500	7	AB up to 3 d. PH (No. 2)

Use Pattern (Crop Group)	Application Parameters ¹				Application Window (Refer to Pollinator Statements Number)
	MSR	MNA	MAR	MAI	
Caneberry (13-A)	0.100	3	0.300	7	AB up to 3 d. PH (No. 2)
Citrus (10)	0.250	2	0.500	10	Anytime up to 0 d. PH (No. 1)
Coffee	0.100	5	0.500	7	Anytime up to 7 d. PH (No. 2)
Cotton	0.062	5	0.310	7	Anytime up to 14 d. PH
Cranberry (13-07-C)	No Foliar Application				
Cucurbit Vegetables (09)	No Foliar Application				
Fruiting Vegetables (08) Plus Okra	0.080	3	0.240	5	AP up to 0 d. PH
Grape	0.050	2	0.100	14	Anytime up to 0 d. PH
Herbs & Spices (19-A)	0.043	3	0.129 ³	5	AP up to 7 d. PH
Hops	0.100	3	0.300	21	Anytime up to 28 d. PH
Leafy Green Vegetables (04-A)	0.047	5	0.234 ³	5	AP up to 7 d. PH
Leafy Petiole vegetables (04-B)	No Foliar Application				
Legume Vegetables (6-C), except Soybeans	0.043	3	0.129 ³	7	AP up to 7 d. PH
Peanuts	0.044	3	0.132	5	Emergence up to 14 d. PH
Pome Fruits (11): Pears	0.250	2	0.500	10	Anytime up to 7 d. PH (No. 2)
Pome Fruits (11): All Others in 11	0.100	5	0.500	10	Anytime up to 7 d. PH (No. 2)
Pomegranate	0.100	3	0.300	7	Anytime up to 7 d. PH (No. 2)
Potato	0.050	4	0.200	7	Emergence up to 7 d. PH
Root Vegetables (01-B) except Sugarbeet ¹	0.044	3	0.132	5	AP up to 7 d. PH
Soybeans (06)	0.047	3	0.141	7	GS : V2, R1, and R3 up to 21 d. PH
Stone Fruits (12): Apricot, Nectarine & Peach	0.100	3	0.300	7	Anytime up to 0 d. PH (No. 2)
Stone Fruits (12): Cherries, Plums, Plumcot, Prune	0.100	5	0.500	10	Anytime up to 7 d. PH (No. 2)
Strawberry	0.047	3	0.141 ³	5	AP up to 7 d. PH (No. 1)
Sugarbeet	No Foliar Application				
Tobacco:	0.050 x 5 + 0.030 x 1	5+1	0.280	7	Emergence up to 14 d. PH
Tree nuts (14):	0.101 x 3 + 0.056 x 1	3+1	0.359	6	Anytime up to 7 d. PH (No. 2)
Tropical Fruits	0.100	5	0.500	10	Anytime up to 7 d. PH (No. 2)
Tuberous Corm Vegetables (01-C)	0.044	3	0.132 ³	5	AP up to 7 d. PH

¹ Note: Rate for Radish in Willowood Imidacloprid 4SC (Registration No. 87290-26)= 0.044 x 1= 0.044; Others included in (01-C)

² Application Parameters: MSR= Max Single Rate; MNA= Max Number of Applications; MAR= Max Annual/Season Rate and MAI= Min Application Intervals in Days noting that rates are in lb. a.i/A.

³ Maximum Rate is seasonal; All others are annual

⁴ Application Window: AP: After planting; PH: Prior to Harvest; AB: After blooming and GS: Plant Growth Stage

Pollinator Statements: No.1= Do not apply within 10 days prior to bloom, during bloom, or when bees are foraging;
No.2= Do not apply pre-bloom, during bloom, or when bees are foraging.

Table A-4 Restricted period in the foliar application windows for pollinator protection

Crop/Crop Group Name (Crop Group, if any)	Restricted Application Window Foliar Application	
	From	To
Bushberry (13-7-B)	Pre-bloom: <i>Early April</i>	End of bloom: <i>End of May</i>
Caneberry (13-7-A)	Pre-bloom: <i>Early April</i>	End of bloom: <i>End of May</i>
Citrus (10)	10 d. Pre-bloom: <i>Late February</i>	End of bloom: <i>Early April</i>

Crop/Crop Group Name (Crop Group, if any)	Restricted Application Window Foliar Application	
	From	To
Coffee	Pre-bloom?	End of bloom?
Cranberry (13-7-C)	No Foliar Application	No Foliar Application
Pome Fruits (11)	Pre-bloom?	End of bloom?
Pomegranate	Pre-bloom: <i>Thru June</i>	End of bloom?
Stone Fruits (12)	Pre-bloom?	End of bloom?
Strawberry (FL)	10 d. pre-bloom: <i>Early November</i>	End of bloom: <i>Early Dec;</i>
Strawberry (CA)	10 d. pre-bloom: Fall (Oct)	End of bloom: <i>Spring (Apr)</i>
Tree nuts (14)	Pre-bloom	End of bloom
Estimated Window Dates	<i>End of April</i>	<i>End of May</i>
Tropical Fruits (Avocado)	Pre-bloom: Avocado: Mid Mar	End of bloom: Mid Apr

Soil Application

- Table A-5** contains a summary of sample formulations used for soil applications of imidacloprid. The summary is based on a sample of 7 labels. Data indicate that imidacloprid appears to be mainly formulated as a flowable/granular insecticide which is applied as liquid spray in case of liquid flowable formulations or in-band/furrow in case of granular formulations. Additionally, the active ingredient in six of the examined formulations is imidacloprid alone with concentrations ranging from 2.5 to 42.8% and one formulation containing imidacloprid concentration of 22.2% with 15.4% fluopyram. It is important to note that the summary in **Table A-5** is based on examination of most of the current imidacloprid labels (not just those shown in the table). This examination was conducted to insure that maximums for the single/seasonal or annual rates, maximum number of applications and minimum application intervals are representative of most current imidacloprid labels;
- Table A-6** contains a summary of the soil use patterns for imidacloprid. The formulations are applied either as liquid or granules. Only one single application is labeled for each of the crop groups/subgroups or crops ranging from 0.18 to 0.50 lbs. a.i./A/season or year. Ground application is used to deliver imidacloprid formulation into the soil as a liquid spray or granular broadcast. Additionally, chemigation may also be used for liquid formulations to deliver the pesticide into the soil. All of the soil application procedures are used to place the pesticide below the soil-surface and into the seed or root zone of the crop. In order to achieve this placement into the proper depth, more than one method may be used depending on the crop being treated;
- Table A-7** contains a summary of methods used for applying liquid sprays to soil using ground equipment. Application information for liquid spray indicate that imidacloprid may be sprayed into the soil, by ground equipment, in band followed by operations to place the pesticide below the soil surface at a depth approximating crop seeding depth/root zone. This application appears to be either at/or just before seeding. Soil application by liquid spray is not expected to produce significant drift when directed into the bottom of the furrow opening as it is usually done by a jet spray that is adsorbed by the soil in the bottom of the furrow and is immediately followed by burial with dry soil. However, drift is expected from application to the soil surface just before incorporation. In both cases, placement of the pesticide below the soil surface is expected to

reduce the amount of run-off estimated by modeling when the pesticide is placed below the 2 cm run-off extraction zone of the model. When the chemical is drenched, injected or applied by chemigation, no drift is expected although part of the chemical may be, partially, subject to run-off depending on the expected distribution of the chemical in the soil profile. The distribution of the chemical with depth in the soil profile will depend on many factors including those associated with the chemical (e.g., solubility and mobility); volume of water used to drive the chemical into the desired depth (e.g., volume of water used in chemigation, drenching and or in watering-in); soil permeability, soil moisture content/distribution with depth; and timing of application in relation to precipitation (volume/intensity) and/or irrigation. In order to achieve accurate placement of the pesticide at depth, labels for imidacloprid stress that the objective, for any of the soil application procedures, is to **place or drive the product into the root zone**. Having the pesticide in the root zone will make it available for upward xylem translocation into the plant foliage. To achieve this, labels suggest to physically place the pesticide at the desirable depth by the application method such as injection or using high drench volumes, application just before expected rain, or irrigation just after application among many others;

- **Table A-8** contains a summary of methods/timing used for soil application of granular formulations (e.g., **ADMIRE 2.5 Granular**) to soil using ground equipment. Based on the granular formulation and the required incorporation to depths >1", drift and presence of the granules in the soil run-off extraction zone are expected to be limited.
- **Table A-9** contains a summary of soil application timing for the various use patterns of imidacloprid;
- **Table A-10** contains restricted period in the soil application windows for pollinator protection.

Table A-5 A summary of sample formulations used for soil applications of imidacloprid

<i>Product Name</i>	<i>Formulation</i>	<i>EPA Reg. No.</i>	<i>Active Ingredient(s) %</i>
Admire® 2 Flowable Insecticide	Flowable	264-758	21.4% Imidacloprid alone
ADMIRE 2.5 Granular	Granules	3125-423	2.5% Imidacloprid alone
ADMIRE™ ® PRO	Flowable	264-827	42.8% Imidacloprid alone
GAUCHO® 550 SC Insecticide	Flowable	264-827	42.8% Imidacloprid alone
TRIMAX™ Insecticide	Flowable	264-783	40.7% Imidacloprid alone
VELUM™ TOTAL	Flowable	264-1171	22.2% Imidacloprid + 15.4% Fluopyram
Willowood Imidacloprid 4SC	flowable	87290-26	40.7% Imidacloprid alone

Table A-6 Soil use patterns for imidacloprid

<i>Use Pattern Crop (Crop Group)</i>	<i>MSR¹</i>
Artichoke, Globe; Banana and Plantain; Bulb Vegetables (03-07-A); Bushberry (13-07-B); Caneberry (13-07-A); Citrus (10): Field; Coffee; Cranberry (13-07-C); Fruiting Vegetables (08): Pepper & Okra; Grape; Pomegranate; Strawberry: Annual During Transplant or for established crop* & Perennial @ Spring before bud opening; Tree Nuts (14); and Tropical Fruits	0.50
Tobacco Applied 0.043 x 11= 0.473 Plus 1 x 0.027 (Twelve Applications) with 7 days' intervals	0.50

Brassica (cole) Vegetables (05); Cucurbit Vegetables (09) ² ; Fruiting Vegetables (08): Eggplant & Tomato; Herbs & Spices (19-A); Leafy Green Vegetables (04-A); Leafy Petiole Vegetable(04-B) ² ; Legume Vegetables, except Peanuts; Pome Fruits (11); Root Vegetables except Sugarbeet (01-B); Soybeans(06-C) ; Stone Fruits (12); Strawberry (13): Perennial @ Post Harvest; Tuberous & Corm Vegetables (01-C); Watercress (Included with Leafy Green vegetables)	0.38
Cotton	0.33
Potato	0.31
Hops	0.30
Sugarbeet (CA only)	0.18
¹ MSR = Maximum Single rate in lb. a.i./A/Year * No application immediately prior to bud opening or during bloom Per Season: Root Vegetables except Sugarbeet (01-B); Tuberous & Corm Vegetables (01-C); Bulb Vegetables (03-07-A); Leafy Green Vegetables (04-A); Brassica (cole) Vegetables (05); Legume Vegetables, except Soybeans(06-C); Fruiting Vegetables (08); Pepper & Okra; Strawberry; Herbs ² Maximum Rate for these two crop groups are seasonal; All others are annual	

Table A-7 Ground soil application methods for liquid sprays (No soil use for soybeans)

Crop/Crop group/subgroup	Method¹	Crop/Crop group/subgroup	Method¹
Artichoke (Globe)	1a & 7a	Leafy Petiole vegetables (04-B)	= Brassica
Banana & Plantain	7a	Legume Vegetables (06), except Soybeans	= Brassica
Brassica (Cole) Vegetables (05)	1a, 2, 3, 4a, 6a & 7a	Peanut	1a & 7a
Bulb Vegetables (03-07)	1a, 2, 6 & 7a	Pome Fruits (11)	7a
Bushberry (13-07-C)	7a & 8b	Pomegranate	7a
Caneberry (13-07-A)	6c & 7a	Potatoes	1a, 2, 3, 4a & 7a
Citrus (10)	7c, 6b, 8a, 12 & 13	Root Vegetables (01-B), except Sugarbeet	1a, 2, 5 & 7a
Coffee	4b, 6b & 7a	Stone Fruits (12)	7a
Cotton	1a, 2 & 7a	Strawberry: Annual & Perennial	7b, 9a, 9b & 14
Cranberry (13-07-B)	7b & 10	Strawberry: Perennial @ Post Harvest	7b, 9b
Cucurbit Vegetables (09)	= Brassica	Sugarbeet	1d
Fruiting Vegetables (08) + Okra	= Brassica	Tobacco	1, 4a & 7a
Grape	4b, 6a, 7 & 16	Tree Nuts (14)	4b, 7a, 12 & 14
Herbs & spices (19-A)	1b, 5, 6a & 7a	Tropical Fruits	7a
Hops	1a, 4b, 6a & 7a	Tuberous and Corm Vegetables (01-C)	1c, 5 & 11
Leafy Green vegetables (04-A)	= Brassica	Watercress	= Brassica

¹ **Descriptions of the Methods:**

- (1) In-furrow spray** directed on or below seed: **(a)** During bedding; **(b)** During setting or transplant; **(c)** Over Hulis (plant material); and **(d)** During bedding immediately prior to planting or at the time of planting;
- (2) Narrow Band Spray** ($\leq 2''$) directly below the eventual seed row during bedding Or over the seed-line incorporated to 1-2'' by irrigation;
- (3) Narrow Band Spray** directly over the raw covered with $\geq 3''$ of soil during Hilling;
- (4) Subsurface side-dress:** **(a) Sprayed on** both sides of the row covered with $\geq 3''$ of soil or incorporated into the root-zone; and **(b) Shank/Injected** on both sides of plants/ trees followed by irrigation within 48 hours;
- (5) Shank-in** 1 to 2'' below seed depth; seed-line; or below Hulis;
- (6) Drench:** **(a) Transplant stage:** Transplant water drench Or **After transplant/seeding: Seeding or Hill drench;** **(b) For Trees: Basal soil drench** into the base/around trees in sufficient water to insure incorporation into the entire root-zone followed by irrigation; and **(c) For Caneberry:** With 500 gal. solution/A; and
- (7) Chemigation** into root-zone through low-pressure drip or trickle irrigation: **(a)** irrigation not specified; **(b)** With 600 to 1,000 gallons of water followed by 0.1 to 0.3'' irrigation within 24 hours; and **(c)** On wetted soil followed by 10-20 minutes of additional irrigation.
- (8) Soil surface spray** in bands:**(a)** On both sides of the tree within the drip-line area of the tree followed immediately with light sprinkler irrigation into the upper portion of the root-zone; and **(b)** On both sides of the row (18'' band) to moist soil followed immediately by 0.5 to 1'' of irrigation/rainfall within 24 hours;

Crop/Crop group/subgroup	Method ¹	Crop/Crop group/subgroup	Method ¹
<p>(9) Soil-surface applications in a minimum of 20 gallons of water/A followed by 0.25" of rainfall or irrigation water/A within 2 hours of application to incorporate product into root-zone: (a) Over-the-row band spray in Annual or Perennial crops; or (b) Raw band spray with width= width of anticipated fruiting bed in Perennial crops</p> <p>(10) Soil Surface spray Directed to the root and crown area with high volume of spray (20 gal)</p> <p>(11) Side-dress no later than 45 days after-planting;</p> <p>(12) High-volume basal drench to slightly moist soil surrounding the tree trunk. Applied in sufficient volume to penetrate the soil to a depth of 18 – 24" (for Termite control);</p> <p>(13) Low-pressure chemigation or Soil surface band spray with irrigation to ensure complete coverage of the root system (Nematode suppression);</p> <p>(14) Emitter or spot application in a minimum of 4 fluid ounces of mixture per emitter site;</p> <p>(15) Plant-material or plant-hole treatment (just prior to, or during transplanting); and</p> <p>(16) Applied by Chemigation or the French plow technique followed immediately by sufficient irrigation to move the product into the entire root-zone of the plant (Nematode suppression)</p>			

Table A-8 Ground soil application methods/timing for granular formulations (Application rates are the same as liquid formulations)

Crop/Crop group/subgroup	Method
Brassica (cole)/fruiting vegetables	<p>(a) In a narrow 2" band centered on the plant row 1 to 2" below the seed depth during bedding <14 days before planting;</p> <p>(b) In furrow application at or below seed level during planting; or</p> <p>(c) As a side-dress placed 2-4" at the side of each row and incorporated at a depth of >1" after the plants are established</p>
Lettuce (head & leaf; direct seeded or transplanted)	<p>(a) In a narrow 2" band centered on the plant row 1 to 2" below the seed depth during bedding <14 days before planting;</p> <p>(b) In furrow application at or below seed level during planting;</p>

Table A-9 Soil application timing for the various use patterns of imidacloprid

Timing¹	Crop (s)/Crop Group(s)
Prior to; at or after planting up to X days prior to harvest	Artichoke (Globe) (X= 7); Bulb Vegetables (03-07) (X= 21); and Strawberry: Annual & Perennial (X= 14)
Prior to or at planting	Sugarbeet
Prior to or at planting up to 14 days prior to harvest	Tobacco
At planting	Cotton; Peanut; and Potatoes
At or immediately after planting up to 21 days prior to harvest	Fruiting Vegetables (08) + Okra
At planting up to 21 days prior to harvest	Cucurbit Vegetables (09)
At or after planting up to X days prior to harvest	Brassica (Cole) Vegetables (05) (X= 21); Herbs & spices (19-A) (X= 14); Leafy Green vegetables (04-A) (X= 21); Leafy Petiole vegetables (04-B) (X= 45); Legume Vegetables (06), except Soybeans (X= 21); Root Vegetables (01-B), except Sugarbeet (X= 21); Tuberous and Corm Vegetables (01-C): Corm (X= 125); Tuberous and Corm Vegetables (01-C): Leaves (X= 3); and Watercress (X= 21)
Anytime up to X days prior to harvest	Banana & Plantain (X= 0); Citrus (10) (X= 0); Coffee (X= 7); Cranberry (13-07-B) (X= 30); Grape (X= 30); Hops (X= 60); Pome Fruits (11) (X= 21); Pomegranate (X= 0); Stone Fruits (12) (X= 21); Tree Nuts (14) (X= 7); and Tropical Fruits (X= 6)
During renovation up to 14 days prior to harvest	Strawberry: Perennial @ Post Harvest
After bloom up to 7 days prior to harvest	Bushberry (13-07-C) and Caneberry (13-07-A)
¹ X days: The value of X is stated in the second column as it varies with the use pattern	

Table A-10 Restricted period in the soil application windows for pollinator protection

<i>Crop/Crop Group Name (Crop Group, if any)</i>	<i>Restricted Application Window Foliar Application</i>	
	<i>From</i>	<i>To</i>
Bushberry (13-7-B)	Pre-bloom: <i>Early April</i>	End of bloom: <i>End of May</i>
Caneberry (13-7-A)	Pre-bloom: <i>Early April</i>	End of bloom: <i>End of May</i>
Citrus (10)	Pre-bloom: <i>Early March</i>	End of bloom: <i>Early April</i>
Coffee	Pre-bloom: <i>Early March</i>	End of bloom: <i>End of May</i>
Cranberry (13-7-C)	Just before pre-bloom: <i>Mid-May</i>	End of bloom: <i>Mid July</i>
Pome Fruits (11)	Pre-bloom: <i>Mid-March</i>	End of bloom: <i>Mid May</i>
Pomegranate	Pre-bloom: <i>Mid-May</i>	End of bloom?
Stone Fruits (12)	Pre-bloom: <i>Early April</i>	End of bloom: <i>Early May</i>
Strawberry	Just before bud opening: Several Weeks?	End of bloom?
Tree nuts (14)	Pre-bloom?	End of bloom?
Tropical Fruits	Pre-bloom?	End of bloom?
References URLs: https://extension.umaine.edu/blueberries/factsheets/integrated-crop-management/integrated-crop-managment-field-scouting-guide-for-lowbush-blueberries/ http://pestmanagement.rutgers.edu/njinpas/CropProfiles/cranberryprofile.pdf http://www.cranberries.org/cranberries/grow_fall.html http://www.stemilt.com/farm-fork/apples/apple-season-begins/ http://ucanr.edu/sites/Pomegranates/files/166141.pdf http://irrec.ifas.ufl.edu/flcitrus/pdfs/short_course_and_workshop/citrus_flowering/Krezdorn-Flowering_and_Fruit_Set.pdf http://www.gardening.cornell.edu/fruit/homefruit/5strawberries.pdf		

Seed Treatment Application

- Table A-11** contains a summary of sample formulations used for seed treatment of imidacloprid. The summary is based on a sample of 12 labels. Data indicate that imidacloprid products, for seed treatment, appear to be mainly formulated as flowable or dust. Additionally, the active ingredient in half of the examined formulations is imidacloprid alone with concentrations ranging from 16.5 to 75% with the other half of the formulations containing 11 to 21% imidacloprid with one or more than one of the following active ingredients: 24% Thiodicarb, 0.415% Tebuconazole, 0.560% Metalaxyl, 0.965% Imazalil, 19.55% captan, 20% carboxin, 1% Metalaxyl, and 56.25% Clothianidin. It is also noted that seed treatment labels have other precautionary/restrictive statements that will be considered in this risk assessment (refer to statements 1 to 4 in **Table A-11**). These statements are related to: covering/incorporation of spilled treated seeds (**statement 1** in 11 of 12 labels); prohibition of the use of planter (hopper) box treatment (**statement 2** in 6 of 12 labels); giving the maximum rate for the combined seed/foliar/soil treatments (**statement 3** in 4 of 12 labels); and specifying the planting depth (**statement 4** in 11 of 12 labels); noting that none of these precautionary statements were present in one of the labels (**IMIDACLOPRID-METALAXYL** product).
- Table A-12** contains a summary of the seed treatment use patterns for imidacloprid. With the exception of a list of crops under the name “seed & pod vegetables”, only one single seed treatment is labeled for individual crops **not** for the whole crop groups/subgroups. The list of the

“seed & pod vegetables” crops are presented in the bottom of **Table A-11** and it includes beans and peas among many other crops;

- **Table A-13** contains a summary of the special kinds of imidacloprid use patterns for treatments of seed pieces, seedlings, containerized plants and cuttings and whips use patterns. Data in **Table A-13** suggest that imidacloprid applied to potato seed pieces, seedlings of tobacco, cucurbit/ fruiting vegetables and polar/cottonwood cutting/whips may be considered as application to soil because the pesticide is transferred to soil with the plant or the planting media. Calculated application rates are as follows:
 - **For potato:** One application of 0.310 lb. a.i./A/Year at planting; noting that the rate was capped to the maximum stated in the label;
 - **For tobacco:** Two application of 0.250 lb. a.i./A/Year with the 1st at planting followed by the 2nd with 7-d interval; noting that the rate was capped to the maximum of 0.5 lb. a.i./A stated in the label;
 - **For cucurbits:** Two application of 0.0204 lb. a.i./A/Year with the 1st at planting followed by the 2nd with a 7-d interval noting that the rate is less than the maximum of 0.38 lb. a.i./A stated in the label;
 - **For fruiting vegetables:** Two application of 0.190 lb. a.i./A/Year with the 1st at planting followed by the 2nd with a 7-d interval noting that the rate was capped to the maximum of 0.38 lb. a.i./A stated in the label; and
 - For citrus: Two application of 0.120 lb. a.i./A/Year with the 1st at planting followed by the 2nd with a 14-d interval; rate is less than the maximum of 0.50 lb. a.i./A stated in the label.
- **Figure A-1** contains a summary of formulations/procedures used for seed treatment of crops. Imidacloprid labels describe three procedures that may be used for seed treatment which appears to be dependent on the pesticide formulation as well as the type of seeds to be treated. As shown in **Figure A-1**, seeds may be treated in commercial seed facilities, at agricultural facilities or by the farmer. At commercial facilities, both liquid and dust formulations are used as slurry to coat seeds with the pesticide in a way that would withstand bagging/storage and transport to farmers during the planting season. In this case, the pesticide coating would probably be made somewhat resistance to abrasion although bagging/storage and transport would probably make the coating somewhat less resistant to abrasion later at planting. At the agricultural facilities, seeds are treated using stand-alone seed treaters with slurry of either liquid or dust formulations possibly similar to commercial facilities. However, in this case, seeds will be treated just before planting suggesting that abrasion during seeding would probably be lower. Treatment of the seeds, by the farmer, using hopper-box, slurry-box, or other seed treatment applications at, or immediately before, planting is expected to reduce the formation of seed coat dust, at planting, when liquid formulations or slurry are used in the treatment. This is because treated seeds are drilled immediately following treatment. Significant dusting-out is of concern when dust formulations are used as a dry mixture in the planter box for seed treatment prior to planting. In this case, high potential of dusting-off are expected causing on-site and to a lesser extent off-site exposure from the dust formulation. The same is expected to occur even from coated seeds due to abrasion before/during planting. The highest exposure is expected from farmer treatments of barley and

wheat with dust formulations of **Enhance® AW** and **Enhance® Plus**; bean and peas with dust formulation of **Enhance® Plus**; and corn (field, pop & sweet), sorghum, and soybeans with dust formulation of **Sepresto 75 WS** (refer to red boxes in the columns designated for dust formulations 1, 2 and 5 in **Figure A-1**).

Dust drifting was recognized in only one of the examined twelve imidacloprid seed treatment label. For **SENATOR® 600 FS** label, the following precautionary statement was included: **“Pollinator Precautions:** Imidacloprid is highly toxic to bees. Ensure that planting equipment is functioning properly in accordance with manufacturer specifications to minimize seed coat abrasion during planting to reduce dust which can drift to blooming crops or weeds”.

It was reported that variable planter dust emissions were observed during planting corn seeds treated with thiamethoxam or clothianidin. As much as 9 ng a.i/cm² of clothianidin or thiamethoxam deposited on slides that were placed in the field (Harold Watters, Ohio State Extension, Personal communication). This mass of a.i of the pesticide translates into 0.80% of the active ingredient coating present in the total corn seeds needed to plant one acre. This amount of dusting was obtained from commercially pre-coated seeds and much higher dusting is expected when a dust formulation is used in the planter box. With commercially pre-coated seeds, dusting-off will depend on many factors such as: the strength of the coating (material, thickness), seed surface characteristics, weather conditions, and type and speed of the planter.

Table A-11 A summary of most seed treatment formulations of imidacloprid

<i>Formulation Product Name</i>	<i>Reg. No.</i>	<i>Active Ingredient(s)</i>	<i>State</i>	<i>Restrictions (Statement No.)¹</i>
AERIS®	264-1057	24% Thiodicarb + 24% IMI	Liquid	1, 2, 3 (For soybean: not >0.38 a.i for seed treatment) & 4
Gaucho® 480 Flowable	264-957	40.7% IMI	Liquid	1 & 3 for cotton only
GAUCHO® XT Flowable	264-971	12.70% IMI	Liquid	1
GAUCHO® 600 Flowable	264-968	48.70% IMI	Liquid	1
RAXIL® MD EXTRA W	264-997	1.384% IMI + Tebuconazole 0.415% + Metalaxyl 0.560%+ Imazalil 0.965%	Liquid	1 & 2
SENATOR® 600 FS	228-522	48.7% IMI	Liquid	1, 2, 3 & 4
Enhance® AW	400-567	19.55% captan + 20% carboxin + 20% IMI	Dust	1
Enhance® Plus	400-568	19.55% captan + 20% carboxin + 4% IMI	Dust	1
Gaucho® 75 ST	264-959	75% IMI	Dust	1 & 2
IMIDACLOPRID 75 ST	42750-121	75% IMI	Dust	1 & 2
IMIDACLOPRID-METALAXYL	264-1044	25% IMI + 1% Metalaxyl	Dust	None of the statements
Sepresto 75 WS	264-1081	56.25% Clothianidin + 18.75% IMI	Dust	1, 2 & 3

¹ **Restrictions: Statement 1:** Exposed treated seed may be hazardous to birds. Cover or incorporate spilled treated seed; **Statement 2:** DO NOT use as a planter (hopper) box treatment; **Statement 3:** The maximum application rate (including seed treatment, foliar application, and soil application) per acre per calendar year for imidacloprid is 0.5 lbs.; **Statement 4:** Treated seed must be planted into the soil at a depth greater than 1 inch;

Table A-12 Summary of labeled application rates for imidacloprid seed treatment use

<i>Use Patterns for Individual Crops; One Crop Group)</i>	<i>Application Rate Calculation in lbs. a.i./Acre¹</i>		
	<i>A= lbs. a.i./One seed Or One lb. of Seed</i>	<i>B= No. of Seeds Or lb. of Seeds/A</i>	<i>A x B Rate (lb. a.i./A)</i>
Barley	9.375E-04	138.30	0.130
Beans ²	1.252E-03	435.60	0.545
Borage ³	1.000E-02	15.20	0.152
Broccoli	8.750E-07	210,845	0.184
Buckwheat	2.344E-04	72.00	0.017
Canola/Rape	1.000E-02	8.23	0.082
Carrot	4.922E-08	2,090,880	0.103
Corn, field	4.219E-03	29.57	0.125
Corn, pop	2.500E-03	22.04	0.055
Corn, sweet	2.498E-03	33.19	0.083
Cotton	5.025E-03	18.89	0.095
Crambe ⁴	1.000E-02	20.00	0.200
Flax ⁵	1.000E-02	45.00	0.450
Leeks	1.477E-07	1,229,929	0.182
Millet	2.500E-03	30.00	0.075
Mustard	1.000E-02	7.00	0.07
Oats	9.375E-04	90.00	0.084
Onions	1.289E-07	1,229,929	0.159
Peanuts	6.234E-04	228.26	0.142
Peas ²	1.252E-03	384.07	0.481
Potato	1.260E-04	34,848	0.878
Rye	9.375E-04	109.00	0.102
Safflower	5.000E-03	35.00	0.175
Sorghum	2.484E-03	9.1	0.023
Soybean	1.252E-03	166.67	0.209
Sugar beet	9.035E-02	4.75	0.429
Sunflower	1.103E-06	25,000	0.028
Teosinte ⁶	2.344E-04	10	0.002
Triticale	9.375E-04	109.00	0.102
Wheat	9.375E-04	156.00	0.146

¹ **Application Rate Calculation in lbs. a.i./Acre** is calculated by multiplying **lbs. a.i./One seed** by the **No. of seeds** needed to seed one acre (values in Red & shaded) **OR** by multiplying **lbs. a.i./One lb. of seed** by the **lbs. of seeds** needed to seed one acre (values in Black). Data for the active ingredient is taken from the label while that for the seeding rate given by BEAD (Acres Planted per Day and Seeding Rates of Crops Grown in the United States; US EPA, March 24, 2011).

² **Beans and Peas rate are equal to the seed & Pod Vegetables rate of the following crops:** Adzuki Bean, Asparagus Bean, Broad Bean (Succulent or Dry), Catjang Bean, Chinese Long bean, Field Bean, Guar Bean, Jack bean, Kidney Bean, Lablab Bean, Lima Bean (Succulent or Dry), Moth Bean (Succulent or Dry), Mung Bean, Navy Bean, Pinto Bean, Rice Bean, Runner Bean, Snap Bean, Sword Bean, Tepary Bean, Urd Bean, Wax Bean, Yard long Bean, Black-eyed Pea (Succulent or Dry), Chickpea, Cowpea (Succulent or Dry), Crowder Pea, Dwarf Pea, Edible-Pod Pea, English Pea, Field Pea, Garden Pea, Green Pea, Pigeon Pea (Succulent or Dry), Snow Pea,

Use Patterns for Individual Crops; One Crop Group)	Application Rate Calculation in lbs. a.i./Acre ¹		
	A= lb. a.i./One seed Or One lb. of Seed	B= No. of Seeds Or lb. of Seeds/A	A x B Rate (lb. a.i./A)
Southern Pea (Succulent or Dry), Sugar Snap Pea, Grain Lupin, Sweet Lupin, White Lupin, White Sweet Lupin, Lentil.			
³ Borage: (SR= 15.2 lbs. seeds/Acre) URL: https://hort.purdue.edu/newcrop/ncnu02/v5-497.html & http://www.harvesttotable.com/2009/04/how_to_grow_borage/			
⁴ Crambe Seeding rate (SR) URL: https://www.ag.ndsu.edu/pubs/plantsci/crops/a1010.pdf ;			
⁵ Flax seeding rate URL: https://www.ag.ndsu.edu/pubs/plantsci/crops/a1038.pdf ;			
⁶ Teosinte =10 lbs. seeds/A: http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/flpmcrb0323.pdf			

Table A-13 A Summary for the special treatments with imidacloprid insecticide for seed pieces, seedlings, containerized plants and cuttings and whips¹

Crop	Treatment For	Treatment Timing/Procedure	Maximum Application Rate
Potatoes ²	Seed pieces	Seed pieces are sprayed with a diluted spray of the formulation. Fungicidal or inert absorbent dust may then be applied	Yearly rate: 0.31 lb. a.i./A/Year 0.252 lb. a.i./A (one Application) (Based on 2,000 lbs. of seed pieces needed to plant one acre; Rate per BEAD is much higher as it is equal to 34,848 lbs. seed/A)
Tobacco ³	Seedlings	(1) In Nursery, pre-plant in trays: Foliar spray followed by foliar wash-off into the potting media by irrigation. 7-days before planting; and (2) In field, during transplant: In-furrow spray; transplant water drench; Or chemigation into root zone Treatment (1) & (2) may be combined	0.274 lb. a.i./A x 2 “two applications”, 7-d interval) (Based on a the maximum of 0.044 lb. a.i./1,000 plants in 2 applications) Should be= 0.250 x two applications= 0.50; Other given rates (different labels): 0.018 and 0.044 lb. a.i./1,000 seedling (Rate is for nursery and field) <i>Pot media is to be transferred into the field with seedlings.</i> Combined Rate with soil: 0.50 lb. a.i./A/Year
Cucurbit Vegetables (09) and Fruiting Vegetables (08) ⁴	Seedlings	(1) In Nursery, pre-plant in trays: 7-days before planting use foliar spray followed by foliar wash-off into soil by irrigation without loss of gravitational water or by Chemigation (direct injection into the overhead irrigation system). And (2) In field: A second application within two weeks of transplanting	For Squash= 0.0204 lb. a.i./A x 2= 0.0408 “two applications”, 7-d interval) For Tomato= 0.204 lb. a.i./A x 2= 0.408 “two applications”, 7-d interval). Should be= 0.19 x two applications= 0.38; (Based on: “0.0156 x 2” lb. a.i./10,000 plants) <i>Media, from nursery, is to be transferred into the field with seedlings.</i> Combined Rate with soil: 0.38 lb. a.i./A/Year
Citrus ⁵	Containerized plants	(1) In Nursery: 7-days before planting: Either (a) To soil media in pot containing plants distant for the field: Applied as soil drench uniformly distributed in the media without loss of gravitational water or by (b) chemigation and/or (2) In field: Chemigation into the root zone or Basal soil drench during	0.120 lb. a.i./A x 2= 0.240 “two applications” with no interval specified; Assume 14-d) (Based on the maximum of 0.000613) Other given rates (different labels): (a) 0.000132; 0.000365; 0.000608; and 0.000613 lb. a.i./pot media or one plant (c) lb. a.i./pot media or one plant <i>Media, from nursery, is to be transferred into the field.</i>

<i>Crop</i>	<i>Treatment For</i>	<i>Treatment Timing/Procedure</i>	<i>Maximum Application Rate</i>
		transplant	Combined Rate with soil: 0.50 lb. a.i./A/Year
Stone Fruits		Root Dip just before planting: by soaking roots to slightly above graft in a 10-gallon solution (0.00313 lb./gal) of the product for five minutes. Then allow to dry/transplant	
Poplar/Cottonwood	Cuttings & Whips	A 24-hour Soak to be absorbed by the plant material (1) Before cold storage for freshly cut plant material that would be planted later, or (2) After cold storage for plant material and just before planting 0.50 lb. a.i./A= The maximum allowed before planting	
¹ Examined labels include: Admire® 2 Flowable Insecticide; ADMIRE™ PRO; GAUCHO® 550 SC Insecticide; TRIMAX™; and Willowood Imidacloprid 45C Insecticide (refer to Table 4, above, for information on these formulations); ² Calculated acre rate for Potato = >4 lb. a.i./A based on BEAD seeding rate of 34,848 lbs. seed/A. Applied as a Uniform Tray drench (broadcast foliar spray to seedlings in trays) not more than 7 days prior to transplanting followed immediately by overhead irrigation to wash the pesticide from foliage into potting media. At transplanting, transplants must be handled carefully during setting to avoid dislodging treated potting media from roots ³ Calculated acre rate for Tobacco= 0.274 lb. a.i./A x 2 based on 6,233 plants/A, URL: http://tobaccoinfo.utk.edu/pdfs/2003burleyprodguide/filesprior2003/chapter8-lastupdated2002.pdf ⁴ Calculated acre rate for Squash= 0.0204 lb. a.i./A x 2 = 0.04808 based on 15,374 plants/A (BEAD); Tomato= 0.2040 lb. a.i./A x 2 = 0.40800 (>0.38) based on 130,680 plants/A (BEAD) ⁵ Calculated acre rate for citrus is based on reported tree density of 194 Trees/Acre, URL: https://edis.ifas.ufl.edu/pi036			

Figure A-1 A summary for formulations/procedures used for seed treatment of crops (Refer to legend)

<i>Crop</i>	Liquid Formulations¹						Dust Formulations²					
	1	2	3	4	5	6	1	2	3	4	5	6
Barley												
Beans												
Broccoli												
Buckwheat												
Canola/Rape												
Carrot												
Corn, field												
Corn, pop												
Corn, sweet												
Cotton												
Flax, Crambe & Borage												
Leeks												
Millet												
Mustard												
Oats												
Onions & Leek												
Peanuts												
Peas												
Potato												
Rye												
Safflower												
Seed & Pod Vegetables												
Sorghum												
Soybean												

[illegible]

Non-Agricultural Use Patterns

(1) Turf & Ornamentals in Nurseries and Residential/Commercial Areas

(a) *Soil Applied Granules/Tablets*: Most labels for this use pattern were examined to obtain application information (**Table A-14**). All formulations in **Table 11** are granular except of **Merit® FXT Tablet insecticide**, which is formulated as tablet with 20% imidacloprid.

Table A-14 Summary of non-agricultural granular/tablet soil applied imidacloprid (IMI) formulations

Product Name	EPA Reg. No.	Active Ingredient(s)	
		IMI %	Others
0.15% Imidacloprid + 0.05% Beta-Cyfluthrin Granular Insecticide	72155-31	0.150%	0.05% β -Cyfluthrin
ALLECTUS® 0.15 G Plus Turf Fertilizer Insecticide	432-1419	0.083%	0.067% Bifenthrin
ALLECTUS® GC Granular Insecticide	432-1416	0.200%	0.16% Bifenthrin
ALLECTUS® G Insecticide	432-1407	0.200%	0.16% Bifenthrin
Allectus 0.15 GC Plus Turf Fertilizer Insecticide	432-1428	0.083%	0.067% Bifenthrin
ALLECTUS® 0.18 G PLUS TURF FERTILIZER Insecticide	432-1418	0.100%	0.08% Bifenthrin
Allectus 0.18 GC Plus Turf Fertilizer Insecticide	432-1426	0.100%	0.08% Bifenthrin
Allectus 0.225 GC Plus Turf Fertilizer Insecticide	432-1427	0.125%	0.10% Bifenthrin
Allectus 0.225 G Plus Turf Fertilizer Insecticide	432-1417	0.125%	0.10% Bifenthrin
Bayer Advanced 2-in-1 Rose & Flower Care Ready-to-use Granules III	72155-95	0.220%	0.10% Clothianidin
Bayer Advanced All-in -one Rose & Flower Care Ready-to-use G	72155-94	0.110%	1.06% Tebuconazole 0.05% Clothianidin
Bayer Advanced 12-Month Tree & Shrub Protect & Feed Ready-To-Use Granules II	72155-96	0.550%	0.275% Clothianidin
IMI 0.22 G T&O Insecticide	53883-226	0.220%	None
IMI 0.3 G Lawn and Ornamental Insecticide	53883-219	0.300%	None
IMI 1% G Insecticide	53883-227	1.000%	None
IMI 0.5 G Insecticide	53883-199	0.500%	None
IMI 0.22G RTS GRANULES Ready-to-Spread	53883-256	0.220%	None

Table I-14 (Continued) Summary of non-agricultural granular/tablet soil applied imidacloprid (IMI) formulations

Product Name	EPA Reg. No.	Active Ingredient(s)	
		IMI %	Others
IMI Termite G (0.5%)	53883-198	0.500%	None
IMI-Lambda G insect Granules	53883-230	0.500%	0.10% λ-Cyhalothrin
Imidacloprid 0.2% Insecticide plus Turf Fertilizer	1381-223	0.200%	None
Imidacloprid 0.5 G - Turf Insecticide	1381-224	0.500%	None
IMID-BIFEN 0.15 LAWN + FERTILIZER Insecticide	42750-156	0.083%	0.067% Bifenthrin
IMID-BIFEN 0.225 LAWN + FERTILIZER Insecticide	42750-162	0.125%	0.10% Bifenthrin
IMID-BIFEN 0.36 GC Insecticide	42750-161	0.200%	0.16% Bifenthrin
ImiBloc 0.5 G Termiticide Insecticide	70506-143	0.500%	None
LADA 0.5G Turf and Ornamental Insecticide	83100-14	0.500%	None
LADA 1.0 G Nursery Insecticide	83100-17	1.000%	None
LADA 2.S G Ornamental Insecticide	83100-16	2.500%	None
LADA™ 0.5G Termiticide	83100-15	0.500%	None
Lawn Insect Control 2	279-3339	0.200%	0.16% Bifenthrin
LPI IMIDACLOPRID 1.0 G	34704-962	1.000%	None
MALICE® 0.2 Plus Turf Fertilizer	34704-979	0.200%	None
Mallet®5 G Tree and Shrub Insecticide	228-567	5.000%	None
Mallet®5 G Turf & Ornamentals Insecticide	228-566	5.000%	None
Marathon 1% G Insecticide	59807-15	1.000%	None
Merit® 0.35 Plus Turf Fertilizer	432-1355	0.350%	None
Merit® 0.45 Plus Turf Fertilizer	432-1356	0.450%	None
Merit® 0.2 Granular Insecticide	72155-44	0.200%	None
Merit® 0.3 G Insecticide	432-1450	0.300%	None
Merit® 0.22 G Plant Treatment	432-1456	0.220%	None
Merit® 0.25 Plus Lawn and Garden Fertilizer	72155-36	0.250%	None
Merit® 1 G Greenhouse and Nursery Insecticide	432-1329	1.000%	None
Merit® 1.1 %Insecticide	432-1472	1.100%	None
Merit® FXT Tablet insecticide	432-1457	20.00%	None
Pro-Mate® Merit® 0.2% With Turf Fertilizer	5905-591	0.200%	None
QUALI-PRO® IMIDACLOPRID 0.5G INSECTICIDE	66222-200	0.500%	None
QUALI-PRO® IMIDACLOPRID 1G Nursery & Greenhouse Insecticide	66222-201	1.000%	None
The Andersons 0.077% Bifenthrin + 0.155% Imidacloprid Granular Insecticide	9198-239	0.155%	0.077% Bifenthrin
The Andersons 0.2% Imidacloprid Insecticide + Fertilizer	9198-236	0.200%	None
TURFTHOR 2.5 G insecticide for turf-grass & landscape ornamentals	83923-9	2.500%	None
TURFTHOR 0.5 G insecticide for turf-grass & landscape ornamentals	83923-10	0.500%	None
Pursell PM with Imidacloprid & Fertilizer	8660-252	0.011%	None
Merit® 0.005% PM Plus Fertilizer	72155-10	0.005%	None

Granular formulations are mostly formulated with imidacloprid as a single active ingredient in the range of 0.005 to 5.0% admixed, in some formulations with 0.067 to 0.16% Bifenthrin; 1.06% Tebuconazole; 0.05 to 0.10% Clothianidin; 0.05% β-Cyfluthrin; and 0.10% λ-Cyhalothrin (**Table A-14**). The only tablet formulation of imidacloprid contains 20% imidacloprid. A summary for the application parameters/procedures for the soil applied granules/tablets formulations are included in **Table A-15**.

Table A-15 A summary of the application parameters/procedures for the soil applied granular formulations (Data for granular formulation unless it is stated that it is for tablets)

<i>Use Pattern</i>	<i>Description</i>	<i>Application Rate & Procedure</i>
Nurseries	Grassy areas	Grassy areas in Nurseries Rate: 0.40 lb. a.i./A x One application/year (Y) Procedure: Ground broadcast application
	Containerized ornamentals	Containerized plants not intended to be used as edible food; Potted foliage, herbaceous plants & shrubs and listed fruit & nut trees Rate: 0.40 lb. a.i./A x One application/Y Rate for tablets: 0.50 lb. a.i./A x One application/Y Procedure: (1) Place and incorporate ¹ the product into the root zone so that the plant can absorb the a.i.; (2) Irrigate moderately, but thoroughly, allowing no leaching and run-off from containers for at least three irrigations or 10 days whichever is longer
	Containerized vegetables	Fruiting and Brassica (Cole) vegetables² distant for resale for transplant Procedure for Tablets: Place 1-4" deep into the media 2" from outside container edge (Veggies not included)
	Ornamentals in field nursery	Field nursery/forest nursery trees/stock Rate: 0.40 lb. a.i./A x One application/Y Rate for tablets: 0.50 lb. a.i./A x One application/Y Procedure: Broadcast in band 6" on both sides of the trees or root ball. Applications must be followed by sufficient mechanical incorporation, irrigation or rainfall to move the a.i. into the soil Procedure for Tablets: At planting: Place in the planting hole under roots; Existing trees shrubs: Place at distances/depths depending on tree/shrub type (2-5" below soil surface) or apply around trees/shrubs 2-5" below soil evenly spaced around the tree trunk and along the drip line
Residential, Farm and Commercial Areas	Landscape Ornamentals: Around the perimeter of industrial and commercial buildings and residential areas, and private wooded/forested areas in state, national, and private forested areas	Ground covers, evergreens, flowering/foliage plants, foliage plants, roses, and small trees & shrubs Rate, including tablets: 0.50 lb. a.i./A x One application/Y (10% of labels) (Note)³ Procedure: broadcast by spreaders drop and rotary types followed by mechanical incorporation and watering-in to move the active ingredient to root zone Procedure for Tablets: Same as in nursery
		Trees, shrubs and non-bearing fruit and nut trees (apple, crabapple, loquat, mayhaw, oriental pear, pear, pecan, and quince), Rate, including tablets: 0.50 lb. a.i./A x One application/Y (10% of labels) (Note)³ Other Rates: 0.0094 to 0.0101 lb. a.i./8" to 10" tall trees Procedure: Spreading in 1-3' circle from the tree/shrub trunk depending on the length of the tree/shrub directly beneath the base of the tree or shrub followed by incorporation of the granules by cultivation, irrigation, rainfall, mechanical placement, or by using mechanical soil mixing equipment Procedure for Tablets: Same as in nursery
	Rodent/Insect Control:	
	Fire ant control: Residential, farm & commercial areas	Rate: 0.44 lb. a.i./A x One application/Y Procedure: Assume broadcast treatment
	Perimeter Treatment: To Control Insects	Rate: 0.40 lb. a.i./A x One application/Y Procedure: Band or spot Treatment 3-5 ft. around homes
	Non-structural Termite Control: To establish residues in the top few inches of soil, killing foraging termites that may be present at the time of application	Rate: 0.40 lb. a.i./A x One application/Y Procedure: Perimeter 3-10 ft. band and/or soil incorporation as spot treatments in advance of final re-treatment of the structure

Use Pattern	Description	Application Rate & Procedure
Turf	Turf Grass Areas: Around residential/commercial/industrial/ institutional/ recreational; parks; athletic fields; business/ office/shopping complexes; airports; cemeteries; and playgrounds	Rate: 0.4 to 0.5 lb. a.i/A x One application/Y Procedure: Broadcast application. Rainfall (within 24 hours), irrigation and mechanical incorporation to move a.i through thatch layer to the soil at the depth of the root zone
	Turf in Sod Farms/Golf courses	

¹**Incorporation** of granules can be achieved by cultivation, irrigation, rainfall, mechanical placement or by mechanical mixing of soil or media;

²**Fruiting Vegetables** include: Eggplant, Ground Cherry, Pepinos, Peppers Tomatillo, and Tomato and **Brassica (Cole) vegetables** include: Broccoli, Chinese Broccoli, Broccoli Raab, Brussels Sprouts, Cabbage, Chinese Cabbage, Cauliflower, Collards, , Kale; Kohlrabi, Lettuce, Mustard Greens and Rape Greens; **Noting** that not all of these crops is grown for seedling in the nursery and this is probably the case for Potatoes, Sorghum, Sugarbeet which was also listed, possibly by mistake;

³**Note:** Application rates were: **One label** @ 0.25 lb. a.i/A x two application/Y= 0.50 lb.; **One label** @ 0.122 lb. a.i/A x two application/year= 0.24 lb.; **64% of examined labels** @ 0.40 lb. a.i/A x one application/Y; and **26% of examined labels** @ <0.33 lb. a.i/A x one application/Y

(b) *Foliar or Soil Applied Liquid Sprays:* Some imidacloprid labels are for liquid formulations that are used as foliar or soil sprays. **Table A-16** contains a summary for the application parameters/procedures for the foliar or soil applied liquid formulations.

Table A-16 A summary of the application parameters/procedures for the foliar or soil applied liquid formulations¹

Use Pattern	Description	Application Rate & Procedure
Nurseries	Grassy areas	Rate: 0.40 lb. a.i/A x One application/year (Y) Procedure: Ground broadcast application
	Containerized plants not intended to be used as edible food; Potted foliage, herbaceous plants & shrubs and listed fruit & nut trees	Rate: 0.40 lb. a.i/A x One application/Y (Note)² Or: 0.20 lb. a.i/A x 2 application/Y (No intervals specified) Procedure: (1) Place and incorporate ¹ the product into the root zone so that the plant can absorb the a.i.; (2) Irrigate moderately, but thoroughly, allowing no leaching and run-off from containers for at least three irrigations or 10 days whichever is longer
	Containerized vegetables	
	Ornamentals in field nursery	Rate: 0.40 lb. a.i/A x One application/Y Procedure: Spray in band 6" on both sides of the trees or root ball. Applications must be followed by sufficient mechanical incorporation, irrigation or rainfall to move the a.i into the soil
Residential , Farm and Commercial Areas	Landscape Ornamentals: Around the perimeter of industrial and commercial buildings and residential areas	Rate: 0.40 lb. a.i/A x One application/Y (10% of labels) Procedure: Foliar spray (ground spray or airblast for trees) or soil spray with water-in to move the active ingredient to root zone; Chemigation
	Bearing Residential Fruit & Nut Trees	Rates (Minimum intervals when applicable): Avocados: 0.094 lb. a.i/A x One application/Y Citrus: 0.094 lb. a.i/A x 3 applications/Y (10-d) Grapes 0.047 lb. a.i/A x 2 application/Y (14-d) Pecans & nut trees: 0.094 lb. a.i/A x 3 applications/Y (10-d)

Use Pattern	Description	Application Rate & Procedure
	Structural Termite Control³: For pre-construction/re-treatment for structural protection from subterranean termites	Rate: One application (cannot calculate from label information) which calls for preparing 0.05% to 0.1% solution followed by applying 4 gallons of the solution/ 10 linear ft. of critical areas and 1.5 gallons/10 sq. ft. for all other areas Noting that: Critical areas include: inside foundation walls, around plumbing, bath traps and utility services; and other areas include: soil to be covered by slab including: basement floor, carports, porches, and entrance platforms
Turf	Turf Grass Areas: Around residential/commercial/industrial/ institutional/ recreational; parks; athletic fields; business/ office/shopping complexes; airports; cemeteries; and playgrounds	Rate: 0.4 to 0.5 lb. a.i/A x One application/Y Procedure: Broadcast application. Rainfall (within 24 hours), irrigation and mechanical incorporation to move a.i through thatch layer to the soil at the depth of the root zone

¹ **Examined Formulations** (All use patterns except those for structural termite control): **AmTide 75% WDG Insecticide** (Reg. No. 83851 -7; 75% IMI Water dispersible granules); **Merit 60 WSP** (Reg. No. 432-1361; 60% IMI Water soluble packets); and **Willowood Imidacloprid 4SC** (Reg. No. 228-588; 40.7% IMI Soluble concentrate)

² **Note:** Label specify the maximum rate/A/Y which would limit the number of pots that can be placed/treated in one acre in a year.

³ **Examined Labels for structural termite control included:** **Liquids:** **IMI 4 lb Insecticide** (53883-237; 42.3% IMI); **IMI 2 lb Insecticide** (53883-229; 21.4%); and **Premise 2 Insecticide** (432-1331; 21.4% IMI); and **Foam:** **Imidacloprid 0.05% Termite Foam** (72155-111) used indoor/outdoor for termites and ants) and **PREMISE® FOAM (432-1391; 0.05% Imidacloprid)** which is for commercial use by Pest Management Professionals

(2) Poplar/Cottonwood and X-mass Trees Plantations

Several liquid formulations are labeled for use on poplar/cottonwood and x-mass trees plantations. Labels for six formulations call for application of the pesticide as foliar spray with two labels calling for either foliar or soil applications. A summary of the application parameters/procedures for the foliar or soil applied liquid formulations is presented in **Table A-17**.

Table A-17 A summary of the application parameters/procedures for the foliar or soil applied liquid formulations on poplar/cottonwood and x-mass trees plantations¹

Use Pattern	Application Parameters ²				Application Procedure/Application Window
	MSR	MN A	MAR	MAI	
Foliar Spray Application					
Poplar/cottonwood	0.1	5	0.50	10	Aerial or Ground (Airblast)/Depending on pest and pest pressure. For cottonwood, application prohibited pre-bloom, during bloom, or when bees are foraging
X-mass trees	0.1	5	0.50	7	
Soil Spray Application					
Poplar/cottonwood	0.50	1	0.50	N/A ⁴	(1) Chemigation through low-pressure drip irrigation; and (2) Shank into root-zone followed by adequate irrigation to promote uptake (i.e. 0.25"/A) (For narrow-row, cutting orchards/nurseries used for plant propagation) When: Early in the year, from break of dormancy through May. Application prohibited pre-bloom, during bloom, or when bees are foraging,
X-mass trees	0.50	1	0.50	N/A	(1) Chemigation into root-zone through low-pressure drip, trickle, micro-sprinkler or equivalent equipment; (2) 18-inch

Use Pattern	Application Parameters ²				Application Procedure/Application Window
	MSR	MN A	MAR	MAI	
					band spray on each side of the row (small trees) to full broadcast application (large trees) followed by rainfall or 0.25 to 1" of irrigation within 12 hours after application.
¹ Examined Formulations: For Soil & Foliar Application: ADMIRE™ PRO ; and GAUCHO® 550 SC ; and For Foliar Applications: PROVADO 70 WG ; Provado® 1.6 F ; PROVADO® PRO ; and PROVADO® Solupak 75% ² Application Parameters: MSR = Max Single Rate; MNA = Max Number of Applications; MAR = Max Annual Rate (Rates are in lb. a.i./A); and MAR = Minimum Application Intervals in days; ³ N/A = Not applicable					

(3) Forestry

Several liquid ready to use tree injection products (**Table A-18**)

Table A-18 A summary of the application parameters/procedures for forestry

Use Pattern	Formulations; Purpose, When/Where/How to Use, and Application Rates
Forest trees: Containerized, Newly Planted, and Established Seedlings	<p>Formulations: SilvaShield™ Insecticide Tablet (432-1484; 20% IMI; each Tablet contains 0.0011 lb. IMI a.i.)</p> <p>Purpose for all formulations: To control insects attacking newly-planted seedlings and established seedling trees in forestry</p> <p>When/Where/ How to Us: (1) Seedling in containers prior to planting: place prescribed tablets 1-4" deep into the soil in the container; (2) Bare-root seedlings, rooted and unrooted cuttings, or small trees at planting: place prescribed tablets 1-3" deep into the soil hole underneath or next to the tree; (3) newly-planted and established trees: Apply 2-5" below the soil surface within 3-5" of the tree.</p> <p>Application Rate: Maximum Rate for in-ground plants: 450 tablets= 0.5 lb. IMI a.i./A/Y; One Application; Maximum rate/tree (in-hole at planting or as soon as possible after planting): Poplar/cottonwood= 1 tablet/tree= 0.0011 lb. IMI/tree; Conifer: 2 tablet/tree= 0.0022 lb. IMI/tree. Therefore, a maximum label rate of 450 tablets/A will treat 450 trees of Poplar/cottonwood or 225 trees of Conifer in one acre.</p>
Trees, Including Forest Trees, And Shrubs	<p>Formulations: Merit® Injectable Capsule (432-1463; 17.1% IMI in 3 and 6 mL capsules of liquid formulation with a density of 9.75 lb./gal "BEAD report"= 0.000440489 lb. IMI a.i./mL; 3 mL capsule contains 0.0013215 lb. IMI and 6 mL capsule contains 0.0026429 lb. IMI)</p> <p>Purpose: For injection into trees in nurseries, greenhouses, and interior and exterior landscaped area, and in private, municipal, state, and national forested areas to control a variety of insect pests of ornamental or forest trees. Not for use on trees where the fruits and/or nuts are consumed</p> <p>Where/When to Use: Post bloom (For bee-pollinated dicotyledonous trees) tree trunk injection of shrubs and trees >2" in trunk diameter</p> <p>Application Procedure: Applied using the Tree Tech microinjection system. Microinjection units should be installed in a hole drilled in the stem and root flares every 6" around the trunk 6-8" from the soil surface</p> <p>Application Rate: Maximum rate= One capsule (0.0026429 lb. IMI a.i./2" of trunk diameter @ chest height (other labels refers to it as the tree diameter at breast height or DBH); For example, if the trunk diameter@ chest height = 12", then the rate= 6 capsules (12 divided by 2). The rate would be 6 x 0.0013215 lb. IMI a.i.= 0.0079288 lb. IMI a.i./12" tree when a 3 mL capsule is used Or 6 x 0.0026429 lb. IMI a.i.= 0.0158576 lb. IMI a.i./12" tree when a 6 mL capsule is used (Label not clear which can be used)</p>

Use Pattern	Formulations; Purpose, When/Where/How to Use, and Application Rates
	<p>Formulations: (1) IMICIDE® HP (7946-25; 10% IMI of liquid containing 110.7 mg of IMI/mL= 0.00024405 lb. IMI a.i./mL; and (2) The same product under the name: Mauget® IMICIDE® (7946-16) in ready to use capsules containing 2, 3, 4, 8, 12, 16 mL ready to use capsules</p> <p>Purpose: Same as Merit® Injectable Capsule, above</p> <p>Where/When to Use: Same as Merit® Injectable Capsule, above</p> <p>Application Procedure: For product (1): Use of liquid loadable, pressure tree injector system. 1st determine the tree diameter at breast height (DBH); 2nd determine the No. of injection sites= DBH divided by 2; 3rd determine total and dosage/tree and dosage per injection site based on DBH in inches: 1st category: DBH >2-10"; 2nd category: DBH 10-36"; and 3rd category: DBH >36. Total dosage for 1st category tree in mL of product= DBH x 1; for 2nd category tree= DBH x 1.5; and for 3rd category tree= DBH x 2. The maximum for all categories is DBH x 2 (heavy infestation/resistant insects). Following determination of the total dosage/tree and the number of injection sites, the dose e site is determined by dividing total dosage/tree by the No. of injection sites. A special rate of 2 mL x DBH (2-23" DBH) and 4 mL x DBH (>24" DBH) are specified, in the label, for USDA supervised treatment program of Asian and Citrus Long-horned beetle. For product (2): determine the total dose, number of sites and the dose for each site the same way as in product (1) then choose the required capsules/capacity needed for the treatment. In each site a hole is drilled into the conductive xylem tissue, the micro injector and feeder tube is combined, feeder tube is placed into the tree and the product is injected into the tree.</p> <p>Application Rate: Example, A tree with 12" DBH; No of sites= 6 (12 divided by 2); Total dosage= 24 mL of product (12 x 2 mL) Or 24 x 0.00024405 lb. IMI a.i.= 0.0058571 lb. IMI a.i./12" tree applied @ 6 sites with 4 mL dose in each site (24 mL divided by 6)</p>
	<p>Formulations: POINTER® Insecticide S (69117-8; 5% IMI of liquid; 0.025 Oz./15 mL= 0.001667 Oz./one mL= 0.00010417 lb. IMI a.i./One mL</p> <p>Purpose: Same as Merit® Injectable Capsule, above</p> <p>Where/When to Use: Same as Merit® Injectable Capsule, above</p> <p>Application Procedure: Applied by syringe that delivers one mL of product into sites (holes) drilled around the base of the tree 12" of the ground. Total dose in mL/tree is determined by the number of sites (holes) which is specified in the label depending on the measured circumference of the tree as follows: 4" (1 site x 1= 1 mL), 12" (3 sites x 1= 3 mL), 24" (6 sites x 1= 6 mL), 36" (9 sites x 1= 9 mL), 48" (12 sites x 1= 12 mL), 60" (15 sites x 1= 15 mL),</p> <p>Application Rate: Example, A tree with 12" Diameter will have a 37.7" circumference. As per label the rate will be 1 mL x 9 sites= 9 mL (36" is the nearest to 37.7"); Total dosage= 9 mL of product x 0.00010417 lb. IMI a.i = 0.0009375 lb. IMI a.i./12" tree applied @ 9 sites with 1 mL dose in each site</p>

(4) Bait & Pellets in farms/residential/commercial areas

Imidacloprid is formulated alone or with other active ingredients as baits, pellets and blocks for use patterns summarized in **Table A-19, A-20 and A-21).**

Table A-19 Summary of the application parameters/procedures for bait & pellets (Rodents & Flies)

Use Pattern	Formulation; Purpose and Where Can Be Used	Application Rate & Procedure
Rodents Plus Infesting	<p>Formulations:</p> <p>(1) Kaput DOOM Smacker Bait (72500-19; 0.02% IMI + 0.005% Bromadiolone); (2) Novel Commensal Rodent Pellet #2: (72500-13; 0.020% IMI + 0.025% Warfarin); (3) Kapuf®-D Combo Bait Blocks (72500-18; 0.020% IMI + 0.005%</p>	

Use Pattern	Formulation; Purpose and Where Can Be Used	Application Rate & Procedure
Flees Control	<p>Diphacinone); (4) Kaput® Combo Bait® Mini Blocks (72500-14; 0.02% IMI + 0.02% Warfarin); and (5) KAPUT® RODENT FLEA CONTROL BAIT (72500-17; 0.025% IMI)</p> <p>Purpose for all formulations: To kill Norway Rats, Roof Rats and House Mice & their infesting fleas (IMI + Rodenticide) Or just rodents' fleas alone (IMI alone)</p> <p>Where/When to Use for all formulations: Indoors or within 50 ft. around homes and other residential buildings, industrial/agricultural buildings and similar man-made structures; ships, trains and aircrafts</p> <p>Application Procedure: (1) Kaput DOOM Smacker Bait: Placed in bait stations with the use of tamper-resistant bait stations indoors. Bait is placed in these stations and fresh bait is added for 10-days or as required. Maximum of 2 blocks for house mice Or 16 blocks for Norway/roof rats (block= one Oz)/station with stations placed 8 Or 15 ft. apart, respectively; (2) Novel Commensal Rodent Pellet #2: Placed in bait; (3) Kapuf®-D Combo Bait Blocks: Placed in bait; (4) Kaput® Combo Bait® Mini Blocks: Placed in bait; (5) KAPUT® RODENT FLEA CONTROL BAIT: Placed in bait</p> <p>Application Rate: (1) Kaput DOOM Smacker Bait: (a) Norway/Roof Rats: Maximum 16 Oz bait= 1 lb. bait Contains 1 lb. bait x 0.0002 lb. IMI= 0.000200 lb. IMI a.i./Bait station (b) House Mice: Maximum 2 Oz bait= 0.125 lb. bait Contains 0.125 lb. bait x 0.0002 lb. IMI= 0.000025 lb. IMI a.i./Bait station</p>	
Flies Control	<p>Formulations: (1) QuickBayt™ Disposable Fly Bait Strip (11556-140; 0.5% IMI + 0.1% Z-9-tricosene; (2) Window Fly Killer (Inside window sticker; 43419-2; 4.3% IMI + 0.21% Z-9 tricosene; (3) PRE-EMPT® FLY BAIT (432-1375; Granular 0.50% IMI + 0.10% Z-9-Tricosene; and (4) QuickBayt® Fly Bait (11556-137; 0.5% IMI + 0.10% Z-9-Tricosene</p> <p>Purpose/Where/When to Use: Product (1): for flies control inside homes Product 2: for fly control in/around commercial livestock facilities (dairy, meat, and poultry processing plants), in/around agricultural production facilities (poultry houses, feedlots and dairies), in/around stables/kennels, and around commercial facilities. Product (3): for fly control outside structures, in/around agricultural production facilities and around commercial facilities Product (4): For the control of nuisance flies scattered in/around livestock facilities, stables, walkways of caged layer houses; and in bait stations inside Swine confinement buildings, and Dairy barns and milking parlors Apply at the start of the season before fly populations have reached their peak</p> <p>Application Procedure: Product 1: Place Bait strips on areas where the flies present; Product 2: Place strips on inside windows; and Products 3 & 4: Applied scatter, in bait stations and as paint-on</p> <p>Application Rate (1) QuickBayt™ Disposable Fly Bait Strip: One strip “ a.i per strip not specified)/250 sq. ft. in 8 weeks when needed; (2) Window Fly Killer: One bait strip (0.0000008265 lb. IMI a.i)/Window. every 6 months; (3) PRE-EMPT® FLY BAIT: Scatter rate: 0.00196875 lb. IMI a.i./1,000 sq. ft. repeat as needed every 7 days; and (4) QuickBayt® Fly Bait: Scatter rate: 0.001875 lb. IMI a.i./1,000 sq. ft. Label did not specify repeated applications (As per registrant the 52 applications/year). Maximum rate= 0.0858 lb. a.i/A/year (registrant value= 0.023?)</p>	

Table A-20 Summary of the application parameters/procedures for bait & pellets (CA ground squirrels and Cat & dog neck collar)

Use Pattern	Formulation; Purpose and Where Can Be Used	Application Rate & Procedure
CA Ground Squirrels Control	<p>Formulation: <i>Kaput Field Rodent Bait B (72500-11</i>; 0.025% IMI + 0.0025% Diphacinone)</p> <p>Purpose: To kill California ground squirrels and reduce fleas that infest the squirrel</p> <p>Where/When to Use: In parks, golf courses, fruit tree orchards (dormant season only), non-crop rights-of-way and other non-crop areas. Apply when squirrels are readily accepting grains</p> <p>Application Procedure: Manually scatter 0.15625 lb. of bait on ground or in modified bait stations (inverted "T" with "elbows" or platform station) near each active burrow. Area treated around burrow may not be >50 sq. ft. Maximum number of applications= 4 with a minimum interval of 2 days</p> <p>Application Rate (lb. IMI a.i./Burrow): Maximum 0.15625 lb. of Bait x 4 applications= 0.0000390625 lb. IMI a.i x 4= 0.00015625 lb. IMI a.i/ Burrow @ 2-day intervals</p>	
	<p>Formulation: <i>Kaput Ground Squirrel Bait (72500-24</i>; 0.0250% IMI + 0.0025% Diphacinone)</p> <p>Purpose: To kill California ground squirrels and reduce fleas that infest the squirrel</p> <p>Where/When to Use: Around buildings including areas such as yards and flower gardens. Assume that it will be applied when squirrels are readily accepting grains</p> <p>Application Procedure: Apply at locations where the bait will be readily accessible to CA ground squirrels (near active burrows) in secured, tamper-resistant bait stations at a minimum of 20 ft. apart. Use a maximum of 4 lbs. per bait station. Insure that an uninterrupted supply of bait is always available for at least 15 days, or until there no longer are any signs of feeding.</p> <p>Application Rate: 4 lbs. bait x 0.025%= 0.0010 lb. IMI a.i/ Bait Station <i>(Note: rate without consideration of the required replenishment of bait during the 15 days period)</i></p>	
Cats And Dogs Neck Collar	<p>Formulations: PNR1427 Insecticide (11556-155; Slow release water resistant neck collar; 10% IMI + 4.5% Flumethrin)</p> <p>Purpose: 8-month prevention and treatment of ticks, fleas, and lice on cats and dogs</p> <p>Where/When to Use: Neck collar when needed</p> <p>Application Rate: Cannot be calculated</p>	

Table A-21 Summary of the application parameters/procedures for bait & pellets (Household insects)

Use Pattern	Formulation; Purpose and Where Can Be Used	Application Rate & Procedure
Household Insects Control: Ants	<p>Formulations: <i>Imidacloprid Ant Killer Station (72155-67</i>; liquid pre-filled spill resistant bait station; 0.005% IMI)</p> <p>Purpose: To kill wide variety/common household ants</p> <p>Where/When to Use: Indoors/outdoors when/where ants are present. Indoors: Attics, basements, bathrooms, closets, dining rooms kitchens, pantries and storage areas. Outdoors: Directly over ant nests/trails or where ants have</p>	

Use Pattern	Formulation; Purpose and Where Can Be Used	Application Rate & Procedure
	<p>been seen entering the building.</p> <p>Application Procedure: Place bait station upright by ant trails or near areas where ants have been Seen (did not specify how many stations/sq. ft.)</p> <p>Application Rate: Cannot be calculated</p>	
Household Insects Control: Others	<p>Formulations: <i>Imidacloprid Granular Bait (73079-14; 0.5% IMI)</i></p> <p>Purpose: To kill ants (excluding carpenter, fire, pharaoh and harvester), roaches, crickets, mole crickets, silverfish, firebrats, and earwigs</p> <p>Where/When to Use: Indoors/outdoors structures, including homes, apartments, commercial, industrial, municipal, institutional, research, recreational, health care, educational, daycare, hospitality and agricultural buildings and other man-made structures, garages, transport vehicles, sewers, animal research facilities, and food service, storage, handling and processing establishments. Turf sites include lawns, landscape beds, ornamental turf, parks, playing fields, right-of-ways, golf course greens and tee boxes, homes, and greenhouses</p> <p>Application Procedure: Outdoors: Use a hand-shaker, duster or mechanical spreader to apply in a band 1-3 ft around the perimeter of the building, edges of sidewalks, patios and driveways and under decks mulch beds, flowerbeds, fruit and vegetable gardens, compost heaps, wood piles, trees, stumps and trash areas and For ants, around trees and stumps, in tree cavities, in and around firewood piles, around landscaping stones and in mulch beds, Turf areas, and along ledges inside sewers and around manhole covers. Indoor Application: Apply in tamper-resistant bait stations in the presence of children or by hand shaker or duster in crack, crevice or void and around many places where the insects may hide.</p> <p>Application Rate: Perimeter Outdoors/Sewer: 0.003125 lb. IMI a.i./1,000 sq. ft., Turf: 0.00255 lb. IMI a.i./1,000 sq. ft., Indoors: 0.00156 lb. IMI a.i./1,000 sq. ft., Re-apply in 7 days (Maximum No. of applications not stated)</p>	